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EDITORIAL NOTES

RESEARCH AND TRAINING

THIS week we publish a substantial portion of the Report for the session 1939–40 of the Livesey Professor, Dr. D. T. A. Townend. It is a report of the most encouraging type. We read it with full and intimate knowledge of the sterling work accomplished by the Fuel Department of Leeds University for the Gas Industry over many years—ever since the endowment of the Livesey Chair in 1910 and especially since the end of the last War. The Department has had a powerful influence on the progress and modernization of the Gas Industry, and it is clear enough from the present wartime report that there is full promise of greater usefulness and extended scope of the work in the future. Men trained at Leeds are to be found carrying out work of importance in every sphere of our Industry's activities, and it is good to note—though it is not surprising—that the war period has emphasized the esteem in which graduates are held by the frequent enquiries for them from different industries. In spite of the war and all its unsettling effects, activities in the Department generally have been little disturbed—giving adequate proof of the fact that the researches being undertaken are essentially of national importance.

We know that on taking up his duties as Livesey Professor Dr. Townend adopted the policy of interfering as little as possible with existing research activities of the Fuel Department—rather of strengthening them as far as possible. This policy has been justified. The work of the Joint Research Committee, of Mr. Hodsman on tars, of Mr. Preece on the scaling of steels, and of Dr. Roberts on refractory materials has in fact gone on from strength to strength. There can be no doubt at all that the recent work of the Joint Committee's research chemists is going to be of great value to the Gas Industry, in whatever direction or directions it is ultimately applied. At the outbreak of war the investigations of the Joint Research Committee on the high-pressure gasification of coal had reached a point when the pioneering work of Dr. Dent and his collaborators had enabled a survey to be made of the possibilities of its practical application as a source of town gas supply. The results of the work were considered sufficiently promising to justify the decision to erect a semi-scale pressure vessel at the Fuel Research Station.

WORK OF FUNDAMENTAL IMPORTANCE

UNFORTUNATELY the incidence of war has hampered progress with this programme of semi-scale work. Much progress, however, has been made in the investigation of other problems complementary to the practical application of the high-pressure gasification process. It is to be hoped that it will not be long before a complete unit making use of the catalytic work will be put into operation. The import of the work is summarized in the report as "the adjustment of calorific value by catalysis, in gaseous systems comprising hydrogen, carbon monoxide, methane, steam, and carbon dioxide." Every effort since the beginning of the present century to adjust composition by catalysis so that full advantage can be taken of equilibria in such systems has been hampered with industrial gases by the short life of the catalysts employed. The work of Dr. Dent and Dr. Key in this field has been of the highest order, and we feel sure that after the war, when the results of their investigations can be published, this work will meet with the recognition from scientific workers which its quality and potentialities merit. To our mind it provides an excellent illustration of developments of fundamental importance as well as of possible practical application in the Gas Industry.

As for the work of Mr. Hodsman—and we owe much to his sympathetic teaching—on the lime treatment of tar, we have followed this with great interest and have referred to it previously in the "JOURNAL." We think it may well lead to processes which will come to stay. At any rate, four roads where his products are being tested by the Leeds City Corporation show promise that they will exhibit all the good qualities of bitumen. The fundamental researches which Professor Townend has himself introduced to the Department have been hampered because much new equipment, workshop facilities, and training are necessary. Concerning lack of accommodation, we had a good deal to say in these columns a year ago, expressing the view that had it not been for the war plenty of financial support for extensions would have been forthcoming from the industries served by the Department—and the Gas Industry is only one of the industries served by it. Nevertheless, much has been achieved, and we note with satisfaction that in his work Professor Townend has been helped by a grant from the Department of Scientific and Industrial Research. The Gas Research Fellow, in collaboration with the Corbet Woodall Scholar, has also carried out some most interesting work on the subject of ignition velocities in aerated burners. This work is keeping on a high plane the advances in our knowledge of the combustion properties of gases in aerated burners.

A NOTABLE LINK

THAT we mention last the collaboration between the Fuel Department at Leeds and the Yorkshire Industrial Gas Development Centre is not that we regard this as by any means the least important matter dealt with in Professor Townend's encouraging report. During the session the Management Committee of the Centre has been working in close collaboration with the Department in pursuing investigations into several aspects of industrial gas utilization. This collaboration has so developed that an arrangement has recently been made whereby the Department will house work of this character and the Centre provide funds to cover incidental expenditure, research assistants, and a rent to the University. Such an arrangement will obviously be of enormous advantage to students in the Department. The scheme has advantages for all concerned; and in this connexion the presence in the Department of the Arthur Duckham Research Fellow and his work has doubtless proved most helpful. The Fuel Department at Leeds can at the present moment, under wartime conditions, be regarded as strong and virile in almost every branch of scientific work of interest to the Gas Industry. Rapid development can confidently be anticipated when peace returns.

We congratulate the Yorkshire Centre upon taking the opportunity thus offered of widening the scope of its activities, and we think we are right in saying that it is only one example of its development under the inspiration of Mr. C. S. Shapley's energetic leadership. If equal opportunity is perhaps not available to every one of the Centres, at least they will do well to look for such chances of broadening their outlook as may be available in their own localities. We know they are doing splendid work; we look to them to play an increasingly important part in the future development of the Industry.

We are Grateful

In times like these it is with a sense of gratitude—and we are sure we are speaking for the Gas Industry as a whole—that we publish the following extract from a letter received by The Institution of Gas Engineers from Major Alexander Forward, Managing Director of the American Gas Association. The letter was dated Jan. 17:

"I need hardly say that the officers and members of the American Gas Association would expect me to convey to the members of The Institution of Gas Engineers their most earnest desire that you may see things through to a successful completion. The courage and tenacity of your people, in the front lines of the war, in both your great and small cities, is a never-ending source of admiration and amazement. That Great Britain carries on as she does—and all of us know how vitally important gas facilities are—is an earnest of final victory."

Tar-Products Control

The Control of Coal Tar Order (S.R. & O., 1941, No. 81) prescribes that no one shall acquire or dispose of any coal tar except under the authority of a licence. This applies also to the treatment of tar. No person shall dispose of any coal tar or coal tar product except at a price or a price exceeding that fixed by a direction given by the Secretary for Mines. Any such direction may be given so as to apply generally or to a particular area. "Coal tar" means any crude coal tar, carburetted water gas tar, and producer gas tar. "Coal tar product" includes (*a*) the constituents of coal tar (whether crude or refined), and (*b*) phenol, the cresols and xylenols derived from any source other than coal tar. "Constituents of coal tar" includes refined tar, road tar, pitch, creosote, blends of creosote and pitch, anthracene oil, green oil, medium and heavy coal tar oils, anthracene, naphthalene, coal tar phenols, tar bases, and pyridine, but does not include benzole or toluene.

Personal

At the first meeting of the newly-formed Central Lincolnshire Area Advisory Committee, Mr. GEORGE WRIGHT, Engineer and Manager of Lincoln Gas Department, was appointed Chairman for the ensuing year. The Committee has been established to meet possible wartime requirements.

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Mr. E. F. DADSON, General Manager of the Imperial Continental Gas Association, has been elected to a seat on the Board.

Obituary

Robert G. Shadbolt

The funeral of Mr. R. G. Shadbolt took place at the Brandwood End Cemetery, Kings Heath, Birmingham, on Feb. 10.

In addition to the family mourners and friends, there were present: Mr. George Dixon, President of The Institution of Gas Engineers, Dr. W. E. le B. Diamond, the Assistant Secretary, Mr. A. W. Smith and Mr. G. C. Pearson, of Birmingham, together with Messrs. Ernest West, R. J. Mieklejohn, J. W. Scott, A. Lowe, S. Whitfield, J. C. Clay, D. Muir, and many of the Brethren of the "Northern Star" and "Murdoch" Lodges.

Floral tributes were sent from friends and many of the Associations with which he was connected.

An Appreciation

The passing of Robert Shadbolt severs a link with the distant pre-War days, and he will not be very well known to the members of our Industry who are in active service to-day. He came of a famous Gas family, for his great-great-grandfather was Manager of the Cambridge Gas-Works in 1812, and was followed by Shadbolts for three generations.

In his early days he was a prominent member of the Methodist Church and often conducted the services. After being at Fleetwood, he was appointed Gas Manager at Grantham, a comparatively small works in those days, to be the stepping-stone to the head of his profession. He was an able and ready speaker, and qualified for the position as one of our leaders by occupying the Presidential Chair of the Eastern Counties and Manchester District Associations, and this work helped to equip him for his later services. He played a prominent part at the time when there were two Gas Institutions—fairly divided between the prominent men in the North and South; and when the present Institution was formed, he was one of the early occupiers of the President's Chair. At Grantham he introduced a new system of carbonization, and was active in trying to reduce the sulphur compounds—a problem still unsolved to-day.

There were many stalwarts in the North associated with his day—the Pattisons, Wests, Carrs, Sellars, Glovers, Ferguson Bell, Young, and Carter, whose names occur to me, all of whom have passed away.

I call to mind his Presidential Year, for I was in London at the time, and the Industry was then experimenting with verticals and Dessau chamber carbonizing systems, and their development largely occupied the interest of our Technical Press. During his time of office, the British Commercial Gas Association was formed along with the aid of Meunier, Mason, Brierley, Goodenough, &c.; and Corbett Woodall was the first President at the inaugural meeting at Manchester in 1912.

Mr. Shadbolt contributed many useful Papers upon the various phases of our Industry, and he was able to hold his own in any arguments affecting them, and had a peculiar habit of putting his head on one side when emphasizing his points. His opinion was frequently sought and willingly given when unexpected and difficult problems were encountered by his associates.

The War years and a long period of sickness affected his activities, and thereafter, although his views upon our Industry were always kept up to date, his public appearances in recent years were infrequent.

In Masonic Circles he always maintained an active interest, for he was a Past Provincial Officer of two provinces, a Founder and the First Master of the Northern Star Lodge and also a member of the Murdoch Lodge.

Many will mourn his loss and our sympathy is extended to his wife and family, to whom he was deeply attached, for he was a beloved and affectionate father.

FROM AN OLD FRIEND.

P. F. Holmes

We announced in the "JOURNAL" last week the death of Mr. Percy F. Holmes, for many years Chairman and Governing Director of Messrs. W. C. Holmes & Co., Ltd., of Huddersfield. He was aged 81.

Mr. Holmes had been actively identified with most phases of Huddersfield life—sport, business, and philanthropy—but he had latterly suffered from rheumatoid arthritis, which had greatly handicapped him, and he had retired from most of his public activities.

Mr. Holmes was a leading figure in the Gas Industry of this country. He had been until three months ago the Chairman and Governing Director of Messrs. W. C. Holmes & Co., which was founded by his father, the late Mr. William Cartwright Holmes, whose gifts of invention were a valuable contribution to the Industry in the middle of the last century. In 1929, in collaboration with Mr. D. M. Henshaw, a fellow Director at the Whitestone Ironworks, Mr. Holmes placed in the hands of The Institution of Gas Engineers a fund for the purpose of endowing a scholarship of the value of £150 per annum tenable at the University of Leeds by a student taking a course in preparation for a responsible position as a gas engineer. The William Cartwright Holmes Scholarship will thus perpetuate the name of the founder of the firm.

His interests in the Industry extended beyond the firm with which he was so associated by family ties, for Mr. Holmes was also a Director of the firm of Messrs. Bryan Donkin, Ltd., Chesterfield, he had been Vice-Chairman of the Society of British Gas Industries, and a Vice-President of the British Commercial Gas Association. He was a member of both the Institution of Mechanical Engineers and an Hon. Member of The Institution of Gas Engineers.

Mr. Holmes, who was educated at Rossall, was as a young man prominently identified with the sporting activities of the district.

Perhaps his biggest contribution to the public life of Huddersfield was his work for the Infirmary, who found in him an indefatigable friend.

He was made a Magistrate for the Borough in February, 1917.

There was a large attendance at the memorial service at the Huddersfield Parish Church on Wednesday last, among those present being Messrs. F. B. Holmes, D. M. Henshaw, C. Cooper, S. G. Watson (all of the firm of W. C. Holmes), Alderman G. Clarke (representing the Bryan Donkin Company), Sir Frederick West (Vice-President of The Institution of Gas Engineers), Messrs. H. Singleton, G. E. Currier, J. A. Drake (Society of British Gas Industries), M. T. Thompson (Drakes, Ltd.), H. Saville (F. C. Sugden & Co.), H. H. Hollis (Oxley Engineering Co.), H. H. Handley (Robert Dempster & Sons, Ltd.), Charles Dempster (R. & J. Dempster, Ltd.), L. Hartley (Clayton, Sons & Co., Ltd.), C. S. Shapley, J. F. Blakeley, and F. W. Clapham (Clapham Bros., Ltd.).

H. C. Head

The death has taken place of Mr. Henry Coleman Head, General Manager of the Winchester Water and Gas Company, and formerly a well-known Consulting Engineer. He was 68.

Born in London, Mr. Head was educated at Manor House School. He was afterwards articled to the late Mr. Frank Livesey, Chief Engineer of the South Metropolitan Gas Company. After five years with this Company, he took up an appointment as Water Engineer and Assistant Gas Engineer at Bournemouth. He went to Winchester in 1904 as Engineer and General Manager of the Winchester Water and Gas Company at a time of transition and difficulty in the Company's activities. His efficiency as an engineer and his business acumen were largely responsible for the advancement in the Company's position. Among his early responsibilities was the removal of the Gas-Works from Staple Garden to its present site at Winnall. His capabilities were later recognized by his appointment in 1929 as Managing Director of the Company. He took a great interest in the welfare of the employees, and his consideration was regularly the subject of appreciative remarks at the annual meetings.

As Consulting Engineer, Mr. Head was responsible for several water supply schemes in the south of England. He was a member of

the Institution of Civil Engineers, of the Institution of Mechanical Engineers, and of the Institution of Chemical Engineers. He was a past-president of the Institute of Water Engineers.

Mr. Head took an active interest in the formation of the British Road Tar Association, of which he was the first Chairman and later Vice-President. He leaves a widow and two sons.

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The death occurred on Feb. 11 of Mr. WALTER HARRY GARDNER, lately of the firm of Clayton, Son & Co., Ltd., Leeds. Mr. Gardner was with the firm in 1907, and was for many years Outdoor Superintending Engineer, a position he filled with high distinction and merit, until ill-health caused his retirement about two years ago. His duties brought him in contact with gas engineers through out the country, and his breezy personality and genial disposition made him a welcome visitor wherever he went. His passing will be deeply regretted by a wide circle of friends, and sympathy will be extended to his widow and daughter.

1941 "Journal" Directory

The undermentioned returns were received too late for inclusion in the 1941 edition of the "GAS JOURNAL" Directory. In order that subscribers may keep the particulars contained in the Directory up-to-date, we shall continue our practice of summarizing in the first issue of the "JOURNAL" each month such changes of which we are advised during the preceding month.

Page 6. BARNOLDSWICK. R. N. Webb appointed E. & M. *vice* H. Spencer, released for military service.
" 10. BRADFORD. Cap., 525,742; Make, 1910; Sales, 1,779; Consumers, 95,166; Oil Gas'd, 393; C.V. Dec. 475; Price, 11.5d.* and 11.9d. *sl.* + 5% or 2-part, 5.1d.* and 5.5d. + stndg. charge + 10%; Extra outside.
" 18. CLEETHORPES. Make, 274; Sales, 248; Consumers, 12,853.
" 32. HERNE BAY. E. F. Smallbone appointed E. & M.
" 80. AIRDRIE. D. L. Dickson appointed E. & M. *vice* A. Kellock, deceased.
" 82. CATRINE. R. A. Harvey appointed E. & M. *vice* R. Brown, retired.
" 90. LOCKERBIE. R. A. Harvey, E. & M., resigned.
" 92. NEWPORT (Fife). D. L. Dickson, M., resigned.

"Bland Light"

His many friends in the Gas Industry will be interested to know that, after recovering from a serious illness which afflicted him last year, Mr. Frederick J. Gould is continuing his business and trading as "Frederick J. Gould late of 'Bland Light'." He has opened offices under this name at 188, Clapham High Street, London, S.W. 4.

National Gas Council

Meeting of the Central Executive Board

A meeting of the Central Executive Board of the National Gas Council was held at Gas Industry House, No. 1, Grosvenor Place, London, S.W. 1, on Tuesday, Feb. 11, at 12.30 p.m. under the Chairmanship of Sir David Milne-Watson, Bart., LL.D., D.L.

The Chairman referred with great regret to the loss sustained by the Industry in the death of Mr. R. G. Shadbolt, who was one of the original members of the National Gas Council when it was temporarily formed in 1916. He had served the Industry faithfully and well, and would be greatly missed from the meetings of the Board. The members of the Board stood in silence as a token of respect to his memory.

It was reported that the annual meeting of the Conjoint Conference of Public Utility Associations had been held on Jan. 29. Lord Falmouth was re-elected as President and Mr. William Cash, Lord Pentland, and Sir David Milne-Watson were re-elected Vice-Presidents. Lord Falmouth, in a short speech, emphasized the importance of the work which was being undertaken by the utilities, and congratulated them on the success that they had achieved in restoring public services interrupted by enemy action. At a meeting of the Council of the Conference on the same day Mr. A. W. Smith, General Manager and Secretary of the Birmingham Gas Department, who had been acting as Chairman since the death of Mr. Woodhouse, was re-elected as Chairman for the coming year.

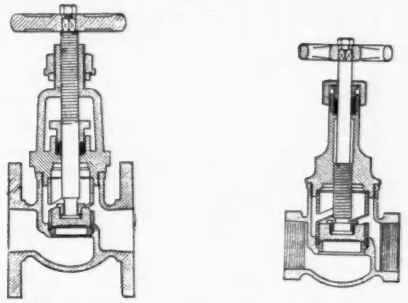
In regard to coal, it was reported that negotiations were proceeding on the questions of (*a*) cancellation of arrears of deliveries under existing contracts, (*b*) standard conditions of contract.

It was agreed that the next meeting of the Board should take place at Gas Industry House on Tuesday, March 11.

On Tuesday, March 4, the Annual Meeting of B.C.G.A. members in the Manchester District, in the Lecture Hall, Manchester Gas Department, will be held at 2.30 p.m.

Eliminating Valve Breakdown

Valve breakdown is most frequently caused by wearing of the seat by steam while the valve is in a slightly open position, attributable to the necessity for working valves in a "cracked" position when very fine regulation is required and the valve is only just open to allow the passage of small quantities of steam. Apart from stoppages for disc renewals and grinding of seats, maintenance costs are continually involved. The improved Arkon seat-in-sleeve valve, sold by Walker, Crosweller & Co., Ltd., Whaddon Works, Cheltenham, is specially designed to eliminate wire drawing. In this new valve the stainless



Type "D." *Type "B."*

Arkon Seat-in-Sleeve Valve. Section views type "D" and "B."

steel seat is protected by a sleeve in which the valve clack moves. Ports are cut in the sleeve so that no steam passes until the valve clack clears the ports. The clack is then well clear of the seat and all wear due to the sudden rush of steam is taken by the sleeve. The valve shuts tight when screwed down on the seat, no matter how worn the ports in the sleeve become. With the Arkon valve only just open it is possible to get very fine regulation while not subjecting the seat to the damaging effects of "wire drawing." The seat is reversible and all the internal parts are renewable. Two types are manufactured; "B" for saturated steam up to 150 lb. pressure, and type "D" for superheated steam up to 650°F. and 300 lb. pressure. They are available in all the usual pipe sizes with screwed or flanged connexions.

Cutting Down Unaccounted-for Gas

In our issue of Jan. 29 (p. 192) we published an article on this subject, with special reference to Dresser clamps and couplings. Unfortunately the blocks of fig. 1 and fig. 2 were transposed. Fig. 1 is the coupling (not the clamp); fig. 2 is an illustration of the leak clamp.

The "Ironmonger" Diary

War conditions have adversely affected the appearance of many annual publications, but the 1941 edition of the *Ironmonger Diary and Hardware Buyers' Guide* is a welcome exception. But for the inclusion of much extremely valuable information about wartime trading, the Diary, which is now in its 73rd year, is indistinguishable from a prosperous peacetime number, and both its literary and advertisement pages are packed with useful material for the retail trader. Few if any trades have been more closely affected by wartime legislation than the hardware business, and the Diary has rendered a great service to the trade by summarizing within the space of about 14 pages the essential points about defence regulations, price control, limitation of supplies, the purchase tax, export credits, steel distribution, war risk insurance, licensing, and paper control.

Coal and Coke Plant

Equipment for crushing, screening, handling, and conveying coal and coke is featured in a new 24-page catalogue of colliery, quarry, and mining requisites issued by Hadfields, Ltd., Sheffield. The wearing parts of all the appliances described are made in Hadfield's patent "Era" manganese steel to ensure high resistance to wear and abrasion, and the rest of the construction is in best toughened cast steel. A page of the catalogue is devoted to a description of "Coalcut" steel, specially suitable for coal cutter picks. In introducing this steel the makers recognized the need for a material that would withstand the incessant shocks incidental to all types of coal-cutting machinery, and equipment in this steel has been supplied to most of the leading collieries in this country with satisfactory results.

The Hawick Gas Company, in co-operation with the Ministry of Food, commenced on Feb. 4 their third session of wartime cookery demonstrations.

Mr. C. Holmes Hunt informs us that his office has been temporarily removed to Flat 2A, 25, Brunswick Square, Hove, as has also the London Office of the Colonial Gas Association, Ltd., of which Mr. Hunt is Secretary.

Producer Gas for Industrial Purposes

The following is reprinted from a leaflet published by Amalgamated Anthracite Collieries, Ltd., of Swansea :

THE heat treatment of practically every metal used in the manufacture of our essential war supplies is of such vital importance that steps are being taken to provide an alternative source of fuel supply in case of emergency. Town gas is at present widely used throughout the industrial areas on account of its convenience and being readily available, but recent experience has shown that the mains are vulnerable to enemy action. Producer gas is the obvious alternative as it can be generated when and where required with comparative ease, if proper attention is given to the suitability of the equipment and the use of correct fuels.

Stationary types of gas producer are available to gasify from 2 cwt. to 20 cwt. of anthracite per hour, but these are usually too costly to be considered for stand-by plant alone. In present circumstances, however, their cost is of little consequence compared with the loss in production caused by damage to gas mains almost anywhere in the area. Consequently, in addition to using well established designs of stationary gas producer, transport types are now being considered and in some cases have already been tried. As operation under stationary industrial conditions differs from those experienced on road vehicles in several important respects, some notes covering these points may assist would-be users.

Producer gas has a calorific value ranging from about 100 to 150 B.Th.U. per cu.ft. (at 60°F. and 30 in. barometer pressure), the highest values being obtained from an up-draught type of generator using anthracite as fuel and water or steam with the air intake. Dry blast operation on a cross-draught producer gives high quality gas during the early stages of its operation, but the quality gradually deteriorates with the fall of fuel level in the hopper. Owing to its lower calorific value compared with town gas (usually 475 B.Th.U. per cu.ft.) burner jets should have a correspondingly greater bore. The air/gas ratio for complete combustion is almost exactly .1. Practically all gas producers will yield about 70 cu.ft. of gas per lb. of fuel gasified.

As transport producers operate on the suction from the engine this power must be substituted by a suction or exhaust fan capable of creating a negative pressure of up to 24 in. water gauge at temperature up to 120°F., without leakage to the outside atmosphere. This fan should be connected between the last cooler or filter on the producer unit and the gas main to the furnaces. Owing to their light construction no transport producer should be operated with a blower or forced draught fan capable of giving more than a few inches water pressure. A combination of blower and exhauster fans can be used if suitable pressure safety devises are incorporated in the system.

As the gas generator, coolers, and filters obtain appreciable air cooling when attached to a road vehicle, additional cooling facilities must be provided to cool the gas from about 700° C. at the generator off-take to about 38°C (100°F.) at the filter outlet, in order to reduce the volume for transmission to the gas mains by fan. Experience indicates that the cost of installing larger mains is better than providing boosting fans to convey producer gas n ex sting town gas mains at high velocity.

Gas producer units incorporating cloth filters or material of a like nature must use bone dry fuel to avoid choking the system by condensation of moisture carried over from the gas generator. Even then, a certain amount will be found in the cooler parts of the system from the inherent or occluded moisture in the fuel and as a result of some of the free hydrogen being burnt in the generator.

Most designs of transport producer operate with dry blast—*i.e.*, no water or steam is allowed to enter the air intake—owing to the difficulty of controlling the precise amount required under the rapidly fluctuating demand for gas on transport work. Industrial requirements are, however, fairly uniform and consequently water can be used to give a blast saturation temperature of 140°/160° F., thus yielding a richer gas and reducing clinker troubles. Under these conditions the cooler and filter units must be capable of continuous operation with wet gas and include means to drain off condensate. Water traps or sumps should also be provided in the gas main.

Transport producers have a very small gasification zone, so that fuel size, type, and quality are of the greatest importance. It is now recognized that a specially prepared fuel is essential for anything approaching trouble-free operation. "Progasite" was the first standardized solid motor fuel to be offered in Great Britain and as such still enjoys unequalled characteristics and merits. Many attempts to use, for example, an anthracite pea have failed and caused considerable expense in repairs and maintenance due to excessive amounts of ash, dust, and tar choking the gas generator unit and mains, and finally abrasion and corrosion of the engine cylinders, &c.

The same limitations apply to transport producers when used for industrial purposes because very few of them are fitted with de-ashing devices, so that the unit must be shut down and the fuel removed from the generator portion to release a relatively small amount of clinker, ash, and dust. As clinker consists of the natural ash in the fuel fusing together, it cannot be avoided, but is reduced to a minimum when using exceptionally low ash fuel. Clinker gradually retards the generation of gas and if not removed will cause a complete stoppage. The tar content must also be very low to avoid choking the filters, mains, and burners.

Certain types of carbonized producer fuels disintegrate on heating and consequently a large proportion of the fuel and its associated ash is carried over with the gas, thus increasing the load on the coolers and filters. With "Progasite" practically all the ash remains in the bottom of the gas generator and thus avoids the necessity of cleaning coolers and filters at every shut-down to remove clinker. They should, however, be cleaned thoroughly after every 100 hours' working.

The high bulk density and calorific value of "Progasite" means that a given volume will yield about two and a half times as much gas as any manufactured solid fuel, so that coupled with its exceptionally low ash content the gas generator unit can remain in operation for very much longer periods.

Gas Undertaking Results

Cardiff

The Cardiff Gas Light & Coke Company are paying a dividend of 6% on the consolidated ordinary stock for the past year. For 1939 the dividend was at the rate of 3% for the first half and £2 13s. for the second half. The balance of revenue carried to Profit and Loss Account on the present occasion is £66,002, which compares with £57,657 a year ago. Manufacturing costs are more than £50,000 up, at £283,192. On the other side, gas rental amounts to £345,003, as against £299,855 a year ago, in spite of the suspension of public lighting, the quantity of gas sold to private consumers showing an increase of 129,961,600 cu.ft., or 7.44%, over 1939.

Derby

The dividend on the ordinary stock of the Derby Gas Light & Coke Company is being maintained at the rate of 7½% for the past year. The balance of revenue carried to Profit and Loss Account is some £11,000 up, at £73,673, though manufacturing costs are nearly £16,000 more, at £157,270, sales of gas having realized £297,677, as compared with £258,944 a year ago. The quantity of gas sold to private consumers shows a substantial increase, at 2,280,828,000 cu.ft. During the year there has been brought into use a new trunk main, laid for the purpose of conveying additional quantities of coke oven gas from the ovens recently erected by the Stanton Iron Works Company, Ltd. As a result, the Langley Mill Gas-Works were finally closed down as a production unit in the latter part of April, and are being demolished. The site is now a gasholder station only.

Ipswich

The interim dividend of the Ipswich Gas Light Company on the ordinary stock was at the rate of 6% per annum, and the payment of a final dividend at the rate of 5½% per annum will leave a balance of £25,415 to carry forward. In 1939 the interim dividend was at the rate of 6½% per annum, and the final dividend was at the rate of 6¼% per annum, with a carry forward of £26,162. The balance of revenue carried to Profit and Loss Account is about £3,000 less than a year ago. The quantity of gas sold to private consumers in the past year was 3,810,791 therms, as against 3,990,507 therms in 1939. The Directors have filled a vacancy on the Board by the appointment, as from March 1 next, of Mr. G. A. Mallett, General Manager and Secretary, who retires after a lifelong service with the Company. He will be succeeded by Mr. W. J. C. Garrard, the present Chief Engineer, who will also become Manager, and by Mr. A. W. Mather, the Accountant, as Secretary. Both these officials, state the Directors in their report to the shareholders, have been in the Company's service for many years, and are tried and capable men.

Sunderland

The Sunderland Gas Company are maintaining their dividend at the rate of 6% for the past year, while the carry forward is increased from £17,344 a year ago to £17,799. The total gas made and purchased in the past twelve months amounted to 7,054,045 therms, which compares with 6,925,965 therms in 1939. Roughly about one-third of the gas is made, and the other two-thirds purchased.

Weston-super-Mare

In their report to the shareholders for the year ended Dec. 31 last, the Directors of the Weston-super-Mare and District Gas Company state that sales of gas show the considerable increase of 34,347,100 cu.ft., or 6.65%, when compared with the sales in the preceding twelve months. The dividend on the consolidated ordinary stock is again at the maximum rate of 5%. The actual quantity of gas sold in the past year was 550,891,300 cu.ft. The balance of revenue carried to Profit and Loss Account is £39,965, which compares with the sum of £34,360 a year ago. An item which appears in the Revenue Account on the present occasion is "Loss on sale of Highbridge Works, £6,659." Receipts from sales of gas are up from £102,053 to £115,532, while residuals have realized over £3,000 more. Manufacturing costs rose from £63,505 to £76,984.

University of Leeds

Report of the Livesey Professor

IN his report for the session 1939–40 the Livesey Professor (D. T. A. Townend, D.Sc., Ph.D., D.I.C.) states that the session under review was marred by the outbreak of hostilities; yet after an unsettling period conditions became more normal, and, on reflection, it is perhaps remarkable that activities generally have been little disturbed. This has been due in no small measure to the action of the Government both in allowing certain undergraduates to complete their University courses and in reserving from military service those with higher qualifications. Also, it is pleasing to record that the war period has emphasized the esteem in which graduates are held by the frequent enquiries for them from diverse industries.

Most of the research activities of the Department, continued Professor Townend, are of national importance. I refer particularly to the investigations of (*a*) the research staff of the Joint Research Committee, (*b*) Mr. Preece under the Alloys Steels Committee, (*c*) Mr. Hodsman on tars and colloidal fuels, and (*d*) Dr. Roberts on British clays; to these may now be added the work of the Yorkshire Industrial Gas Development Centre. We have held the view that as far as is reasonable an endeavour should be made not to dismember the groups of specialist workers in these fields; for apart from the importance of their work they are available for emergency problems.

During the Session a request was received from a Committee under the Chairmanship of Professor David, constituted to organize a University war effort, that an analytical laboratory should be set up in order to undertake metallurgical analysis and testing work for the Admiralty and Ministry of Aircraft Production, should this become necessary. A number of assistants were trained by Mr. Preece in rapid methods of analysis and the Department is now carrying out a certain amount of work of this character. In another direction the workshop staff of the Department is helping as far as is possible in war production work undertaken in collaboration with Professor David's organization.

In my first Report (1938–39) I made clear the inadequacy of the present accommodation, financial support, and workshop facilities, to meet the needs of the training and research for which we are responsible ; and I pointed out the general view that the time had come when machinery should be set up to consider the best procedure for embarking upon a new development scheme. Unfortunately the war had intervened and the whole matter therefore had to remain in abeyance. The agreement with this view and the promise of support conveyed by members of the Livesey Advisory Committee at its meeting were, however, both gratifying and encouraging; and I therefore look forward to more settled times when this issue may be reopened.

It is perhaps fitting that I should record that, following conversations which I was privileged to have with individual members, there was found to be a consensus of opinion that the Livesey Committee should function as an organizing body of any development scheme, and that it should appoint to advise it a Sub-Committee to which might be co-opted individuals associated with those related industries whose interests comprise a large part of the work of the Department. It is hoped that in due course conditions will allow of the formation of this Sub-Committee. Some relief to shortage of accommodation has been made possible by certain alterations and additions to Departmental outbuildings. With the kind concurrence of Mr. Henry Woodall, the Corbet Woodall Experimental Gas Plant has been modernized, the cronite retort being now housed in a gas furnace constructed by the Thermic Equipment Company. Also, roofing of part of the open structure adjoining the plant has been effected to provide for the installation of high pressure gasification (Lurgitype) equipment together with washing and purification stages. Elsewhere the conversion into a laboratory of a disused fives court located behind the Department has been successfully completed and it has now been equipped for the work of the Joint Research Committee.

Yorkshire Industrial Gas Development Centre

During the Session the Management Committee of the Yorkshire Industrial Gas Development Centre has been working in close collaboration with the Department in pursuing investigations into certain aspects of industrial gas utilization. This collaboration has so developed that an arrangement has recently been made whereby the Department will house work of this character and the Centre provide funds to cover incidental expenditure, research assistants, and a rent to the University. The advantage to our students of contact with such work need hardly be stressed; and it is hoped that from time to time the Centre will maintain certain post-graduate men to work on problems of mutual academic and industrial importance. We have been indebted to Mr. C. S. Shapley, Chairman of the Management Committee, whose understanding and appreciation of the value of such work have contributed greatly to this project. It has undoubtedly potentialities for all parties concerned.

During 1939–40 there were 32 registered students of the Department, grouped as follows: 1st year B.Sc. course 5; 2nd year B.Sc. course 2; 3rd year B.Sc. course 6; Diploma 2; Post-graduate Research 12; Post-graduate Diploma 2; Private Industrial Research 3. This compares with 33 students in 1938–39 and 42 in 1937–38. The introductory courses in Fuel and Metallurgy, taken as either part of the Mining and Engineering training or as an additional subject by Chemistry and other students, were also attended by some 40 students.

Research

It may be recalled that at the outbreak of present hostilities the investigations of the Joint Research Committee on the high pressure gasification of coal had reached a point when the pioneering work of Dr. Dent and his collaborators had enabled a survey to be made of the possibilities of its practical application as a source of town gas supply. (45th Report, unpublished in the national interest.) Moreover, the results of the work were sufficiently promising to justify the decision of the Joint Panel on Complete Gasification under Pressure of the Fuel Research Board and the Joint Research Committee to erect a semi-scale pressure vessel at Greenwich in order to confirm the characteristics of the process with plant larger than was operable in the laboratory. Unfortunately the incidence of the war has hampered progress with this programme of semi-scale work. Considerable progress has been made, however, in the investigation of other problems complementary to the practical application of the high pressure gasification process. These relate more particularly to (*a*) the possible need of pre-treatment of a bituminous coal to overcome any difficulties incidental to "swelling," and (*b*) the adjustment of calorific value by catalysis in gaseous systems comprising hydrogen, carbon monoxide, methane, steam, and carbon dioxide.

The possible use of methane, whether compressed or in liquid form, as a wartime fuel for motor transport has also directed attention to the importance of devising a process whereby supplies of this gas might be forthcoming from the Gas Industry should they be required. The experience already gained in the catalytic synthesis of methane from carbon monoxide and hydrogen as part of the high pressure gasification programme has been applied to this end with considerable success. Indeed, many of the difficulties inherent in this "Sabatier" synthesis—*e.g.*, deposition of carbon, poisoning of the catalyst by sulphur, and ageing of the catalyst—now appear to be far less formidable than has been accepted by chemists for more than 30 years. The promise of these investigations reflects the greatest credit on the research chemists concerned; day and night operation has been involved over a long period and I cannot praise their work too highly.

It should also be recorded that on the outbreak of war the Joint Committee decided to suspend the programme of work relating to the combustion characteristics of town gas. Mr. Wood and Dr. Eastwood who previously were engaged upon it have since been collaborating in the main investigations.

Mr. J. E. Garside (University Scholar), under the direction of Mr. H. J. Hodsman, has carried further the study of the fluidity of coal tars, which has been prosecuted in several directions. In regard to road binders laboratory work has been accompanied by road trials, which by now have been of such duration as to confirm anticipations that disabilities usually associated with tars can be removed. Road surfaces laid in busy traffic thoroughfares in Leeds have shown marked superiority over those incorporating products of current type.

Other work has been directed to the blending of tars and pitches with mineral oils so as to render the application of pitch as a liquid fuel independent of the use of creosote. The incompatibility of tars and mineral oil has hitherto been an obstacle to the use of pitch as a liquid fuel; but it has now been found possible to produce liquid blends which have remained stable for many months. Such blends are capable of supporting commercial pulverized fuel in permanent suspension, and offer a means of preparing "colloidal fuel" should the supply of imported fuel oil need reinforcement from inland sources. Such an application would in effect mean a new application of pitch.

The investigations into the oxidation of special steels by the Alloy Steels Research Committee of the Iron and Steel Industrial Research Council have been continued by Mr. Preece with the assistance of Mr. R. V. Riley and Dr. G. Parker. Results have been forthcoming which have direct application in present-day industrial practice and the Committee is continuing its full financial support of the research.

Dr. G. Parker, Carnegie Research Scholar since 1938, was awarded the degree of Ph.D. for a thesis on "The Stability of Sulphur Dioxide and Hydrogen Sulphide in Furnace Atmospheres and their Influence on the Formation of Heat-resisting Films on Alloy Steels." He has recently entered the service of I.C.I. (Metals) Ltd., Birmingham.

Mr. K. C. Choudhuri has also examined the influence of stress in causing failure of steel by inter-crystalline penetrations of solder and bearing metals; for his thesis on this subject he was awarded the degree of M.Sc. He has now returned to India.

Mr. E. Ineson, B.Sc., has defined the liquidus-solidus curves of the iron oxide-iron sulphide equilibrium diagram and presented a thesis for which he received the degree of B.Sc. with second class Honours. He has now entered the service of David Brown & Co., Ltd., Huddersfield.

Mr. E. Heaton (Smithells Scholar) has continued the study of the

fundamental properties and mineralogical constitution of British clays used in the manufacture of refractory materials and glazed fireclay ware. It is felt that this work, in which the most up-to-date methods of identifying the minerals present in clays are being used, will contribute to a better understanding of the nature of such materials and to their more efficient utilization.

Investigations on Refractory Materials

Three men entered the Department during the Session to carry out industrial investigations on refractory materials. Mr. H. Thompson, for the Leeds Fireclay Company, continued his work, and Mr. R. Kumar of Jullundur City, Punjab, India, was engaged on experimental work in connexion with the manufacture of graphite crucibles from Indian clays. Mr. J. W. Best, of the Ceramic Research Department of Imperial Chemical Industries, Ltd., took advantage for a short time of the facilities afforded by this Department for testing refractory materials.

Mr. D. G. R. Davies (Corbet Woodall Scholar since 1936), who took the B.Sc. degree in Gas Engineering in June, 1939, spent a fourth year as a research student and presented a thesis on " The Measurement of Ignition Velocities of Ethylene-Air Mixtures at Atmospheric and Reduced Pressure." In this work a new approach to the measurement of ignition velocities was made with results likely to open up an important new field of investigation. For his thesis he was awarded the degree of B.Sc. with second-class Honours, and he has since entered the service of W. C. Holmes & Co., Ltd., Huddersfield.

Mr. A. R. Hall, M.Sc., came to the Department after graduation from the Chemistry Department in order to pursue post-graduate study and research in the field of combustion. At the end of the Session he was awarded the degree of M.Sc. for a thesis entitled " The Measurement of the Velocities of ' Cool ' Flames in Ether-Air and Oxygen Mixtures by Means of Shadow Photography."

The Department of Scientific and Industrial Research has made a special grant for the Sessions 1939–40, 1940–41, in order to provide an assistant and apparatus for the continuation of certain researches into the mechanism of the combustion of higher hydrocarbons and their derivatives in which I was engaged while at the Imperial College, London. Mr. J. E. C. Topps, B.Sc., of University College, Southampton, has been appointed to this post.

Mr. J. S. Forsyth, B.Sc., of the University and Royal Technical College, Glasgow, has held the Gas Research Fellowship since December, 1938. In collaboration with the Corbet Woodall Scholar he has made systematic investigation of the methods of measuring ignition velocities in aerated burners, a feature of the work being the wide range of conditions examined. The results show great promise, and new light has been thrown upon the influence of pre-flame processes in both stationary cones and travelling flames.

The Department has welcomed among its members during the Session under review the second Arthur Duckham Research Fellow, Mr. E. C. W. Smith, B.Sc., formerly Radiation Research Fellow at the Imperial College, London, who has been making a special spectrographic study of the emission from refractory oxides under flame impact. Results of very great interest have already been forthcoming from Mr. Smith's work ; the phenomenon of "luminescence " at temperatures below that required for thermal emission has been established beyond question, and this has been shown to be closely related to the " fluorescence " exhibited by the same materials under the influence of ultra-violet light. The field opened up is a wide one, and equal importance attaches to work in higher temperature regions, where abnormalities in emission in the infra-red region of the spectrum may be of considerable practical importance. A first report on this work had been approved for publication.

Mr. D. C. Gunn, B.Sc.(Eng.), Secretary of the Yorkshire Industrial Gas Development Centre, has been working upon the design and efficiency of a gas-heated furnace, in which the hot fuel gases are withdrawn through the refractory lining. Other subjects of investigation being pursued are the carburation and ignition of coal gas-air mixtures in engines used for motor transport, and submerged combustion ; Mr. Gunn is also collaborating with Mr. Smith and Dr. Roberts on special gas heating processes involving selective infra-red radiation.

GASHOLDER CUPS AND DIPS

By H. H. HOLLIS,

Chairman and Managing Director, Oxley Engineering Company, Ltd.

MR. S. M. MILBOURNE is to be congratulated on giving us so much information regarding his methods of determining the positions of flooding holes in cup skirting plates.

It is essential that gasholder cups and dips must be designed to prevent " blowing," but are flooding holes necessary in order to prevent this fault ? Some years ago, two members of my Staff (Mr. S. Stansfield and Mr. J. B. Oxley) set to work on this problem and evolved the very simple device shown in figs. 1, 2, and 3. This device has been patented. Full particulars are given in Patent Specification No. 505,119, but the illustrations given here are self-explanatory. It is really uncanny to see the water returning to the cup *via* the short leg of the duct at the psychological moment to prevent " blowing." These overflow and return ducts have been fitted to several gasholders, with conspicuous success. They definitely prevent external flooding, gas " blowing," and oil troubles. In the case of gasholders oil filmed internally only, the oil picked up by the cups each time the holder is inflated is returned to the inside of the holder *via* the port-holes.

Before these ducts were fitted to an existing gasholder, oil filmed internally only, during heavy rain the oil was washed out of the cups, over the dips, and finally deposited between the outer lift and the tank wall. During the process, the film of oil on the water contained by the wall of the lift became gradually thinner until it was rendered ineffective, allowing the gas to pick up moisture from the surface of the water. I was informed by the Maintenance Engineer that after the oil deposited between the outer lift and the tank wall had reached a depth of 2 ft, it was pumped back to the surface of the water inside the lifts. Serious " blowing " had taken place during the process of uncupping since the gasholder had been built, and in consequence

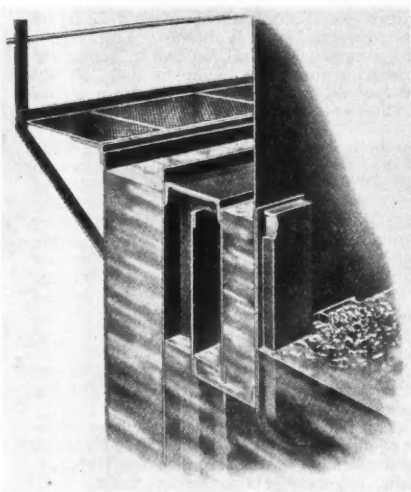


FIG. 1.—*Cupping.*

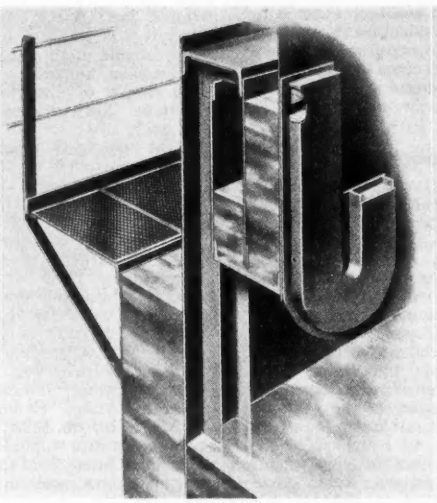


FIG. 2.—*Inflated.*

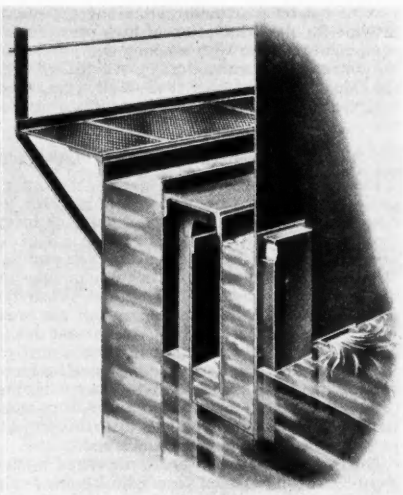


FIG. 3.—*Uncupping.*

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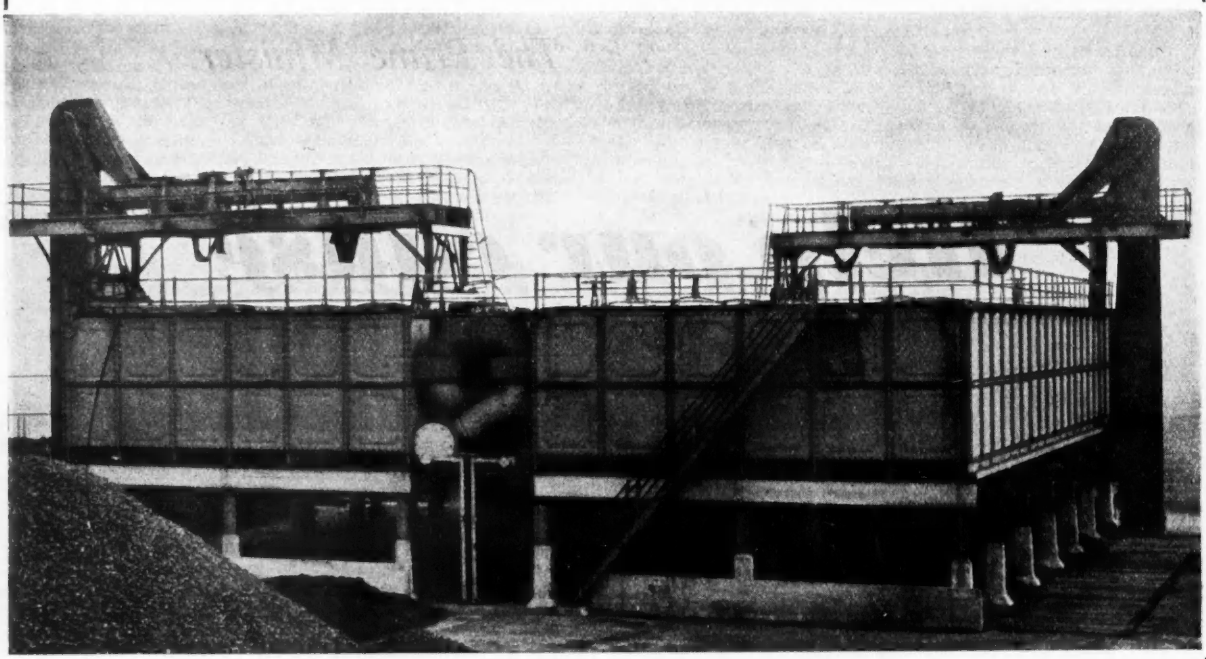

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of this, corrosion had taken place at the point of " blowing," necessitating repairs. It would have been a costly business to alter the construction of the cups and dips, which were of the bent plate type. The simple device illustrated overcame the trouble with regard to " blowing " and also kept the film of oil inside the lifts.

Reverting to flooding holes, these cease to be effective if there is excessive unequal settlement of the tank foundations, whereas the height of the weirs around the port-holes leading to the ducts can be easily adjusted (for the sake of clearness, these weirs are not shown in the accompanying illustrations).

Regarding the design and construction of the cups and dips, if these *must be* rivetted, the square type should be constructed

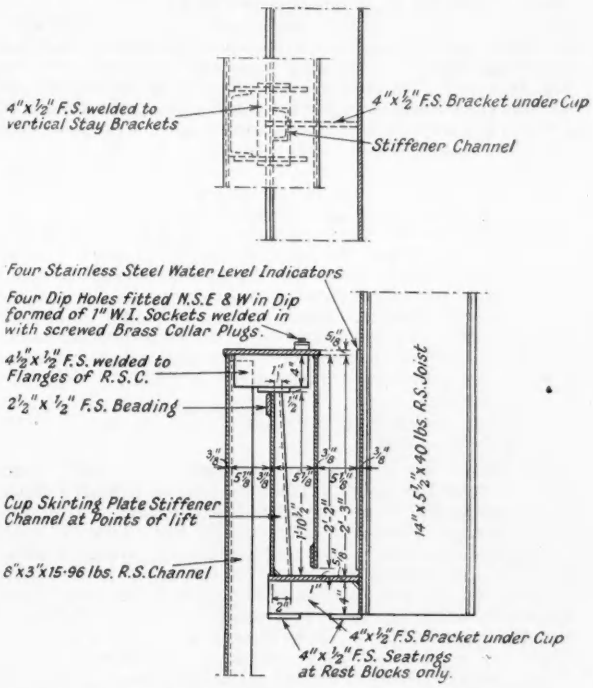

4"x½" F.S. welded to vertical Stay Brackets
4"x½" F.S. Bracket under Cup
Stiffener Channel
Four Stainless Steel Water Level Indicators
Four Dip Holes fitted N.S.E & W in Dip formed of 1" W.I. Sockets welded in with screwed Brass Collar Plugs
4½"x½" F.S. welded to Flanges of R.S.C.
2½"x½" F.S. Beading
Cup Skirting Plate Stiffener Channel at Points of lift
8"x3"x15·96 lbs. R.S. Channel
14"x5½"x40 lbs. R.S. Joist
4"x½" F.S. Bracket under Cup
4"x½" F.S. Seatings at Rest Blocks only.

FIG. 4.—*Arrangement of Welded Gasholder Cup and Dip. (Patent applied for.)*

of plates and angles, not channels. I have seen many dips constructed of 7-in. channels, with a web less than ¼ in. thick, badly distorted and corroded. On medium-sized holders, the base of the cup and the top of the dip should be not less than ⅜ in. thick, and on large gasholders not less than ½ in. thick.

We are constantly being called upon to repair cups and dips, chiefly by welding reinforced plates to the cup plate at the wind-and-water line. In many instances the space between the lift and the dip skirting plate has been 2 in. and less, making these repairs very difficult indeed. This space should be not less than 5 in. on new holders.

The many weaknesses found on the orthodox rivetted cups and dips led to the welded design described in our Patent Specification No. 527,604. Fig. 4 gives details suitable for a large gasholder. It will be observed by studying this design that the plate which takes the load—*i.e.*, the cup skirting plate—is provided with suitable vertical stiffeners at the lifting points. All plates used in the construction of these cups and dips can, of course, be of any desired thickness—a distinct advantage over the orthodox construction, where channels are used.

On spiral-guided holders, where it is not possible to fix the carriages immediately over the lifting points, plate stiffeners are welded to the underside of the dip top plate, the side of the lift and skirting plate, forming a strong rigid box girder. In my opinion, this stiffening is necessary, particularly on large holders. In connexion with the rivetted channel dips, I have seen considerable distortion of the channel, due to the load on the carriages being transferred to the dip. In one case, in addition to distortion, the dip skirting plate had split near the toe of the channel. This may have been due to the load on the carriages (the splits were opposite several of the carriages) or due to the strain when cupping. In my opinion, it is important that the bottom edge of the dip skirting plate should be well clear of the cup bottom plate, and only act as an apron or curtain plate. Let the cup skirting plate do the lifting and design accordingly.

The accompanying sketch, fig. 4, illustrates simple and inexpensive fitments which I consider should be on all gasholder cups and dips, either new or old—at points N., E., S., and W. The exact seal inside and outside the cups can then be recorded by the use of a dip stick and readings of the gauges—most useful where the holder is considerably out of level.

A word to gas engineers in closing. Please do keep your cups clear of deposits, also lower the water in your cups occasionally, and thoroughly scrape and clean the cup plates and dip skirting plates at the wind-and-water line, afterwards applying a good paint. With regard to steelwork on gasholders in general, and cups and dips in particular, always remember that " a scrape in time will save you a dime."

PATENTS

Coke Grates

Patent No. 529,955 (application date, June 13, 1939), granted to the South Metropolitan Gas Company, Sidney Flavel & Co., Ltd., G. H. Fuidge and S. W. B. Flavel, relates to grates of the kind in which a grating is carried by a separate supporting frame which is spaced from the floor so that an ash-pan may be inserted underneath it.

According to the invention in such a grate the supporting frame has side members which comprise deflector plates which are adapted to deflect ashes falling on the side members towards the central portion of the ash pan, the attachments of the side members to the front and back members of the frame being adjustable so that the space between the side members may be varied.

The attachments may be such that the side members may be moved apart or inwards and/or that each side member may be set at another angle. In this way the grate can be adjusted to suit a variety of fireplaces of differing width and/or shape. The presence of the deflector plates prevents ashes from accumulating outside the ash pan.

Such an accumulation of ashes would prevent a close fit of the ash pan in the grate being obtained. The accuracy of control of the ventilation of the grate depends on the close fit of the ash pan and this is of considerable importance, particularly with coke burning grates.

In a preferred form the side members of the frame, which is mounted upon short pillars to provide the necessary spacing from the floor, each incorporate a depending sheet or apron which slopes so as to deflect —*i.e.*, at an angle of about 40° to the horizontal—ashes towards the centre line of the fire. The side members are bent at their ends so as to form a substantially horizontal portion which is slotted in a direction transverse to the length of the side member. The front and back members of the frame consist of bars apertured near each end to accommodate an upstanding pin over which the slotted ends of the side members fit. The pin and slot mounting thus provided is locked either by screwing the pin into the aperture in the back or front member, or in cases when the pin is secured therein, by a nut on a screw-threaded part of the pin. The front member of the frame, if desired, may be curved when the invention is applied to a grate with a curved front.

In order to prevent any risk of the side members becoming loose when hot it may be found desirable to provide a series of countersunk recesses along the length of the slots in the side members. In this case the adjustment of the width of the frame will of course be reduced to a number of sizes within the range provided by the length of the slots.

It is found advantageous to make the two slots in each side member parallel, so that during adjustment, the distance between the front and back of the frame remain constant. Alternatively two parallel series of holes may be provided.

The pin and slot mountings between the front, back, and side members of the frame allow the width of the frame to be varied or the angle at which the side members are set to be varied, or both, while the deflector sheets ensure that the ashes fall well inside the side members of the frame and thus into the ash pan. Because of this feature it will be unnecessary to provide a special ash pan to suit any particular adjustment of the frame.

The grating to be carried by the frame may conveniently carry at its sides outstanding bars by which it is supported on the frame, the width of the grating and its shape being adjusted by cutting off the ends of the laterally extending bars after the frame has been adjusted. The bars may be notched to facilitate this.

The invention may conveniently be applied to a gas-ignited coke fire grate, in which case the gas supply may be arranged near or within one of the pillars upon which the supporting frame is mounted, and led to a row of burners behind the front of the grate, the burners being arranged at such an angle that the flames impinge on the coke from underneath the grating. The invention is applicable to any grate which burns solid fuel.

CO-ORDINATION OF LOW AND HIGH PRESSURE SUPPLIES *

By J. B. WALSH, *Assistant Distribution Engineer, Stockport Gas Department*

MODERN methods of gas distribution are vastly different from those existing 30 or 40 years ago. Probably the chief reason for this great difference is the gradual introduction of gas into every heating field. This has resulted in the transference of the peak load, in most cases from the evening hours (formerly due to the lighting load) to the hours between 6 a.m. and 5 p.m.

Before the introduction of what may be termed high consumption domestic appliances such as geysers and wash boilers, the quantity of gas supplied at any peak period was such that its delivery presented no problems which could not be solved by anything more than a slight increase in pressure. In short, the main feature of a satisfactory distribution system was, and still is, a number of trunk mains of sufficient size to deal with the maximum load.

In recent years the load factor has altered to such an abnormal extent that this same provision—*i.e.*, adequate trunk mains—would entail the laying of trunk mains of such a size that the cost would be enormous. It should be remembered, moreover, that these mains would only be working to anything approaching capacity for a few hours per day. The alternative to laying new trunk mains of adequate size is to augment the L.P. (low pressure) supply by means of H.P. (high pressure) feeds, the position of such feeds being determined by local conditions.

The use of H.P. supplies forms a basis for an extremely flexible output. Sudden and heavy demands in any particular area can be met by building up the supply to that area by means of a H.P. governor feeding into the L.P. mains.

Several alternative methods are available for using the H.P. system. We may feed into holders in outlying districts from which distribution is by L.P., we may boost or build up the pressure in predetermined areas, or we may supply a district entirely by means of a H.P. main, such H.P. being cut down by suitable governors to a normal district pressure. Local conditions alone will be the deciding factor in the ultimate choice of one or other of these systems, each of which has its own particular merits. Where a H.P. main is laid solely for boosting purposes, in the initial stage of the scheme, it probably fulfils its duty with entire satisfaction—*i.e.*, it is capable of supplying the full quantity of gas needed for a period of several hours. A greatly increased load for such a comparatively short period invariably results in the laying of H.P. mains in preference to L.P. trunks solely on grounds of expense.

But from this simple beginning a more complex state of conditions is quite likely to arise. As the demand of a rapidly growing area increases, so also must the amount of H.P. gas and so also must the hours of boosting be increased to meet this demand, and ultimately a set of conditions is reached where the H.P. boosters must be run all day, and instead of being a supplementary supply as originally intended, they gradually assume the position of an integral part of the distribution system. Isolated cases do occur where it has been found quite impossible to lay new trunk mains of the necessary size from the works to the district, and in this case there is no other alternative to laying H.P. mains to a point beyond the congested areas.

These investigations were carried out in an attempt to elucidate the following points :

(*a*) To determine the effect of fluctuating pressures on—
  (1) The unaccounted-for gas figure.
  (2) The efficient working of appliances.
(*b*) To determine what proportion of the total load is being carried by the H.P. and L.P. mains.
(*c*) To determine the total cost of distributing gas by high pressure and low pressure.
(*d*) To determine whether a district supplied solely by a H.P. feed is more economically supplied than the one fed otherwise.

Need for Constant Pressure

Every gas consumer, large or small, expects and should receive gas of an unvarying quality at a steady pressure. Fluctuating district pressures can only lead to erratic working of appliances. A governor controlled appliance is, of course, immune from such variations, and should provide satisfactory working even under conditions of varying pressure. Apart from this inconvenience caused to consumers, the raising and lowering of district pressures indiscriminately, whether intentional or otherwise, may bring several other problems in its train. These may be summarized as follows :

(1) Consumers' meters are tested at 2 in. pressure. Modern conditions call for a pressure greatly in excess of this figure and an average pressure of at least 5 in. for the major portion of the day may safely be assumed. Where this great disparity of pressure is entailed an appreciable difference in the volume of gas charged and the volume of gas passing may prove to be a considerable item where several thousand meters are concerned. It is the usual practice to make a correction which will compensate for the reduction in volume due to increased pressure—*e.g.*, if a district pressure is raised from say 4 in. to 5 in., the drop in volume will have a considerable effect on the unaccounted-for gas figure. Where a correction figure is applied to deal with a specific pressure, then any pressure exceeding this figure will mean an ultimate loss which will come under the heading of unaccounted-for gas. District pressures should be decided by the distribution engineer and rigidly adhered to by the works staff. Any considerable variation in pressure due to inefficient planning and governing will have a similar effect.

(2) *Effect on Gas Consumption Chargeable for such Services as Public Lamps.*

The alternative methods of charging for public lamps are : (*a*) by an average meter reading—*i.e.*, one lamp of a group is metered ; (*b*) by an estimated consumption. Whichever system is used, a lamp governor should form a part of each installation. It may happen that lamps are erected without governors, in which case the constant pressure is absolutely essential for economical working. Arguments are sometimes advanced that, irrespective of pressure, a lamp is adjusted to pass the requisite number of B.Th.U. to give a maximum efficiency. The answer to this is that the average lamp attendant cannot distinguish any difference in the light given by the lamp under small varying pressure conditions. In other words, he may set a lamp at a pressure of 3 in. on one day, and if on the following day a pressure of 4 in. is being maintained, the same attendant will consider the lamp quite satisfactory without any further alteration. To prove this point a test was carried out on a 4-light globe lamp. The first set of readings were obtained by adjusting the lamp at a pressure of 2 in. The pressure was then increased by 1 in. stages to 6 in. without any alteration to the adjustments.

In. W.G. Pressure.	Consumption cu.ft. per hour
2	8
3	9
4	12
5	13
6	13½

No Adjustment of Burner

In the second set of readings the lamp was readjusted after each pressure increase to give, in the opinion of the attendant, a good light.

In. W.G. pressure	Consumption cu.ft. per hour
2	7½
3	9
4	10
5	10½
6	11

Adjustment made after each Pressure Increase

This illustrates plainly that while theoretically a lamp requires only a certain number of B.Th.U. irrespective of pressure, the human element is such that fine adjustments cannot satisfactorily be made. The need for a constant pressure is therefore obvious. Assume a town with 5,000 street lamps. If the excess consumption is 1 cu.ft. per hour per lamp the total loss is as follows : Total lighting hours per annum, 4,000 hours. Excess consumption 5,000 × 4,000 = 20,000,000 cu.ft. Cost at 1s. 6d. per 1,000 cu.ft. = £1,500 loss per annum.

* From a Paper to the Manchester and District Junior Gas Association, Feb. 1.

(3) *Test on a Gas Cooker.*

(*a*) Cooker oven without thermostat. In this example the alteration in consumption could be easily calculated, but an actual test is always more reliable.

Pressure in. W.G.	Consumption cu.ft. per hour
2	19
3	24
4	26½
5	28
6	36

Oven without Thermostat, no Adjustment of Burner after Pressure Alterations

(*b*) Where an oven is thermostatically controlled, the pressure increase will be nullified by the thermostatic action, but as shown by the following results, the correction is somewhat slow, taking a full half-hour before the consumption is reduced to the set rate. Pressure variations on a district will produce similar results and will undoubtedly mean the under or over cooking of foodstuffs, particularly when the cooking period is limited to half an hour or less.

The first table of results was taken by allowing the oven temperature to settle for a quarter of an hour after each pressure rise.

Pressure in. W.G.	Consumption cu.ft. per hour
2	15
3	15
4	21
5	20
6	20

This indicates that a quarter of an hour is not sufficient time for the increased pressure to be thermostatically corrected; so a further series of figures was obtained to show the result after half an hour was allowed to elapse for the oven to recover its true gas rate.

Pressure in. W.G.	Consumption cu.ft. per hour
2	12
3	12
4	12
5	12
6	12

These results clearly demonstrate the effect of fluctuating pressures on but two appliances. Constant pressure is obviously a definite necessity as both the thermal efficiency and the performance depend on a definite gas rate.

The problem resolves itself into the provision of some means of augmenting the supply to outside districts; the method adopted, whether a district holder, a H.P. receiver, or H.P. boosting, is immaterial. The first procedure is obviously to determine those areas which suffer from a lack of pressure at any time of the day.

Determination of Low Pressure Areas

An integral part of any distribution system is a series of district pressure recorders placed in such positions that the whole of the area of supply is under constant observation. Daily charts taken from these recorders will supply the distribution engineer with much valuable information, information which will form the basis of his programme of future work in connexion with increased trunk mains and high pressure supplies. It is in this connexion that the broad outlook as to future development is of such value. It is no uncommon occurrence for a builder to start a small estate on the outskirts of the district which may be fed by a small service main. After a short period it may be found that this small estate has grown to a very large one and adjoins a similar estate advancing from the opposite direction. In time a main by-pass road is constructed, running through both estates, which provides an excellent opportunity for laying a new trunk main at a comparatively low cost. If the potentialities of this district had been neglected and the estates fed by service mains only, a heavy expenditure would be necessary to replace the service mains by the large trunk mains. Alternatively the development may start from the construction of the by-pass road, in which event the development of the adjoining area as an industrial or a residential area follows usually as a matter of course.

Small feeder mains may in some cases be responsible for a lack of pressure at the time of peak load, and in a town where economy has been the keynote of the distribution programme, this trouble may be pronounced. In short, we may be faced with a large number of districts suffering from this shortage of supply which can be cured simply by the enlargement of the feeder mains into that area. Broadly speaking, however, lack of pressure will be confined to several district areas situated on the outskirts of the district, in which case a choice must be made between the laying of a larger trunk main and the laying of a high pressure main.

The value of pressure wave street lighting (where fitted) should not be overlooked when investigations are proceeding in connexion with ascertaining the low pressure areas. Observations taken at the time of the low pressure wave will indicate quite clearly (*a*) the districts where an increase of pressure is quickly effective, and (*b*) those areas where lighting up is much delayed, these constituting the low pressure areas. Valuable and interesting information may be found from these observations. In one instance it was found that the pressure wave travelled a distance of about three miles, *via* a trunk main to the centre of the district, and returned along a separate trunk towards the works, and the last lamps to be lighted were situated about a quarter of a mile from the works.

Comparative Costs of Low and High Pressure Mains

When the question of increased supplies is under consideration, two different sets of circumstances may arise: (1) Where the laying of a L.P. trunk main or a H.P. main is quite optional —*i.e.*, the deciding factor is usually based on economic grounds; (2) Where the laying of a L.P. trunk is definitely impossible due to overcrowded paths and roadways, or in some cases a large number of bridges to be crossed. It should be borne in mind that the course of a river or rivers running through a town must definitely have some considerable bearing on the course of the proposed main, inasmuch as in many cases the possible crossings may only be accomplished at existing bridges, due to both banks of the river being already built upon.

It is not the object of this Paper to attempt to set forth the comparative costs of low and high pressure mains and their economical limits, but rather to indicate the observations that should be made on an existing system to determine the proportion of work done by each respective system, and how possible economies may be effected.

The load factor, generally defined as the ratio of the average hourly load expressed as a percentage of the maximum hourly load, has been an influential factor in the radical changes which have occurred in the methods of gas distribution in recent years As previously mentioned, modern appliances have a consumption far in excess of older appliances ; this is not referring to, say, cookers and fires, which actually have an individual consumption lower than previous types, due to improved design, but mainly to geysers and industrial appliances. Collectively such appliances as cookers and wash boilers will produce a mid-morning load far exceeding anything previously encountered. This load, coupled with the steady load arising from the application of gas to every industrial purpose, places an unusual strain upon the distribution system. The effect of this is to necessitate some means of augmenting normal supplies by one of the means already discussed—*i.e.*, by boosting or pressure increases.

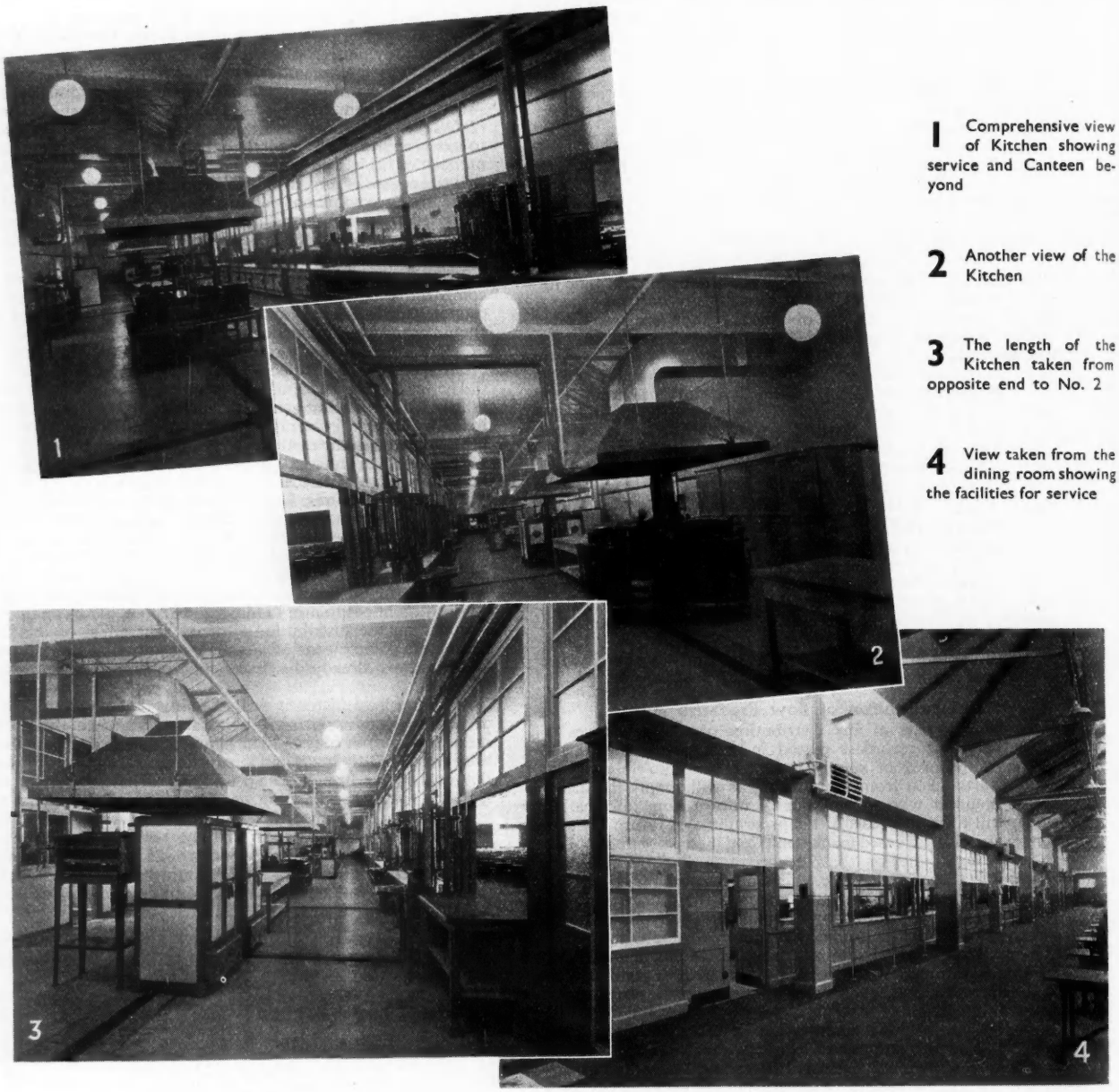
A falling load factor is an indication that the consumption at peak periods is growing at a faster rate than the normal increase in output of gas. The figures shown in Table I indicate the average hourly loads and the maximum taken on the heaviest day in the year from 1925 up to 1937. These particular days were picked as representing the peak load conditions in each year, and in each case this day is in the week immediately preceding Christmas. Unfortunately, records of hourly consumption were not available prior to 1925, otherwise a remarkable difference in the load factor would be noticed comparing the results 30 years ago and those of to-day. The load factor is also shown in Table I.

TABLE I.—AVERAGE AND MAXIMUM HOURLY CONSUMPTION FIGURES WITH LOAD FACTOR FOR ONE DAY IN EACH YEAR FROM 1925–1937.

Year	Average hourly load (1,000 cu.ft.)	Maximum hourly load (1,000 cu.ft.)	Load factor
1925	181	248	73
1926	193	302	64
1927	196	299	64
1928	190	322	59
1929	190	287	66
1930	186	299	62
1931	192	289	66
1932	179	287	62
1933	205	349	58
1934	186	336	55
1935	218	350	62
1936	207	367	55
1937	221	393	55

(*To be concluded in a forthcoming issue*)

MODERN GAS CANTEEN



1 Comprehensive view of Kitchen showing service and Canteen beyond

2 Another view of the Kitchen

3 The length of the Kitchen taken from opposite end to No. 2

4 View taken from the dining room showing the facilities for service

The illustrations above show Radiation appliances in the Canteen Kitchen of a large factory engaged on war work.

INSTALLATIONS

TECHNICAL and other problems connected with the planning and equipping of Hospital, Hotel and Industrial Canteens and Kitchens are the constant study of the Radiation Large Cooking Equipment Section.

Canteens and Kitchens are being equipped in all parts of the country and the illustrations on facing page will give an idea of the size of some of these installations.

Knowledge and experience, coupled with unrivalled designing and manufacturing facilities, ensure in advance the right practical approach to every project. Many of the most successful Canteens are evidence of this Radiation care and forethought and of their skilled assistance to Gas Undertakings in the carrying out of such work.

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PATENTS

Purification of Combustible Gases

Patent No. 528,848 (application date, April 6, 1939) is concerned with gas purification. It has been granted to the Gas Light & Coke Company and R. H. Griffith, and relates to an improvement in or modification of the process claimed in British Patent No. 489,398.

In that patent there is claimed a process for the catalytic oxidation of organic sulphur compounds in combustible gases from which the hydrogen sulphide has already been substantially completely removed which comprises passing the gas containing a small percentage of oxygen at a temperature not exceeding 350°C. over a catalyst comprising nickel or cobalt.

It has now been found that in applying this process to gases such as coal gas, which contain unsaturated hydrocarbons of relatively high molecular weight, the activity of the catalyst is gradually reduced owing to the gradual accumulation of hydrocarbon material thereon, and ultimately the catalyst has to be rejected or regenerated. The harmful hydrocarbons are of the type of indene, styrene, and conjugated diolefin hydrocarbons and appear to undergo polymerization when adsorbed on the catalyst even at temperatures of 200°C. and upwards. They are harmful to the activity of the catalyst even when present in small concentrations, of the order of a few grains per 100 cu.ft. of gas. It is an object of the invention to reduce or eliminate this harmful effect.

The process comprises treating a gas of the type referred to, from which hydrogen sulphide has been substantially completely removed, to remove the unsaturated hydrocarbons of relatively high molecular weight therefrom and subsequently passing the gas containing a small percentage of oxygen at an elevated temperature, preferably between 200° and 350°C., over a catalyst comprising nickel or cobalt to oxidize the organic sulphur compounds therein. The removal of the unsaturated hydrocarbons may be achieved by washing the gases with an oil, such as gas oil, or by passing them through an adsorbent material such as active charcoal.

In one method of applying the invention to the treatment of coal gas the gas before being brought into contact with the catalyst is washed with gas oil, 20 to 25 gallons of oil being used for each million cu.ft. of gas. The washing may take place in a static or rotary washer of the type used for the removal of naphthalene from coal gas and the conditions under which the washing is carried out may be similar to those employed for the removal of naphthalene. In the initial stages of the washing the gas oil quickly becomes saturated with low boiling hydrocarbons of the benzole range after which it functions simply to remove the high boiling heavy hydrocarbons.

The fouled oil may be withdrawn and used, for example, in the manufacture of carburetted water gas or it may be regenerated by distillation and recirculated for washing the gas.

The washed coal gas is then brought into contact with a nickel or cobalt catalyst as described in Patent Specification No. 489,398 so as to oxidize organic sulphur compounds contained therein.

Any of the known processes for recovering benzole from gases will also remove the undesired heavy hydrocarbons referred to above, and the process of the invention may be carried out by treating the gases in a benzole recovery plant prior to passing them through the catalytic plant for the oxidation of the organic sulphur compounds. However, when an adsorbent material is used for the recovery of benzole it is found preferable to arrange for the benzole recovery plant to follow the catalytic plant, and in this case it is preferred to subject the gases prior to their entering the catalytic plant to the oil washing treatment described above for the removal of undesired heavy hydrocarbons, which does not remove the benzole to an appreciable extent.

Removal of Oxygen from Gases

This is the subject of a patent (No. 530,983; application date, June 24, 1939) granted to the Gas Light & Coke Company, R. H. Griffith, and P. Lloyd. It applies particularly to the removal of oxygen from gases containing hydrogen and in which the amount of oxygen is of the order of 0.1% or 0.2% by volume or less.

Substantially complete removal of such quantities of oxygen from gases which also contain hydrogen is obtained in accordance with the invention by bringing the gases into contact with a catalyst consisting of or containing a subsulphide of nickel or of cobalt at a temperature above 120°C. whereby the oxygen is converted into water. The temperature is preferably maintained below 200°C.

The invention may be used for the purification of electrolytic hydrogen in which small quantities of oxygen are often present as an impurity. It may also be used for the treatment of the reducing gases used for the bright annealing or tempering of metals where the complete absence of oxygen is necessary. These reducing gases may be prepared by the partial combustion of coal gas arranged so that a small proportion of hydrogen persists unburnt. It is usually found even in reducing gases prepared under these conditions that some free oxygen is present. This oxygen can readily be converted to water by the process of the present invention.

The process may also be applied to the quantitative determination of the oxygen content of a hydrogen-containing gas as the water formed in the catalytic combination of oxygen and hydrogen may be weighed or the contraction in the gas volume may be measured. When such measurement is carried out in a suitable apparatus the contraction may be used to operate an instrument giving a continuous record of the oxygen content of the gas. A record of this type is often important where large volumes of hydrogen are used under high pressure.

The catalyst used is very resistant to poisons. Thus, for example, it is entirely unaffected by the presence of sulphur compounds in the gas undergoing treatment.

Following is a description by way of example of one method of carrying the invention into effect. The gas from which the oxygen is to be removed contains 99% of hydrogen and 0.2% oxygen. It is pre-heated to about 180° to 200°C. and passed over a nickel sub-sulphide (Ni_9S_8) catalyst at such a rate that a space of 1 cu.ft. packed with the catalyst material will treat 1,500 to 2,500 cu.ft. of gas per hour.

The maximum quantity of oxygen which can be converted per unit time at a given temperature by a given amount of catalyst does not depend on the oxygen content of the gas treated—*i.e.*, the reaction leading to the conversion of oxygen to water is of zero order with respect to oxygen. The gas velocity and the temperature have therefore to be adjusted according to the total amount of oxygen which can be dealt with per unit time.

Preparation of Catalysts

Improvement in the preparation of catalysts is the subject of Patent No. 529,711 (application date, Feb. 25, 1939), taken out by the Gas Light & Coke Company, R. H. Griffith, and J. H. G. Plant. It has particular reference to the preparation of nickel and cobalt sub-sulphide catalysts of the type employed in Specification No. 489,398. In that specification the catalyst was prepared by soaking a porous supporting material such as china clay in a hot aqueous solution of nickel or cobalt chloride, precipitating the corresponding hydroxides in the pores of the support, by soaking in caustic soda, removing chloride by washing, reducing the nickel or cobalt hydroxide to the corresponding metal and thence to sulphide and sub-sulphide by heating in a stream of gas containing hydrogen and a proportion of organic sulphur compounds.

It is an object of the invention to provide an alternative method for the preparation of supported sub-sulphide catalysts which method is cheaper and more efficient than that described in Specification No. 489,398. The process for preparing a sub-sulphide catalyst for use in the removal of organic sulphur compounds from combustible gases, such as coal gas, may be greatly facilitated and cheapened by using as the starting material nickel or cobalt in the form of a salt containing oxygen and sulphur and subjecting the salt to reducing conditions such that the nickel or cobalt sub-sulphide is formed directly.

The present invention accordingly comprises a method of preparing a sub-sulphide catalyst of nickel or of cobalt which consists in soaking a porous support in a solution, preferably an aqueous solution, of a salt of nickel or of cobalt containing oxygen and sulphur which salt is directly reducible to sulphide, drying the impregnated support and converting the salt to sub-sulphide by heating at a temperature between 300° and 500°C. in a stream of hydrogen or of a gas containing hydrogen. The temperature of reduction is preferably of the order of 350°C. The salt of nickel or cobalt employed may conveniently consist of sulphate, sulphite or thiosulphate, but of these compounds the sulphate is preferred.

The reducing gas in which the sulphate is reduced should be substantially free from hydrogen sulphide but may contain a smaller proportion of oxygen. In one preferred method of carrying out the invention the salt is reduced by means of the gas which is to be treated for the removal of organic sulphur compounds. Substances having the property of activating the sub-sulphide catalyst may be added to the solution of the salt.

The nickel or cobalt salt is introduced into the surface layers of a support such as pellets of burnt china clay by maintaining the solution at or near its boiling point, or alternatively by exhausting the air from the support and immersing the support in the solution. It has been found that boiling for approximately 5 minutes is sufficient to obtain an effective layer of nickel sulphate in the surface pores of china clay pellets.

The drying of the support is preferably carried out at or about 100°C. for one to two hours, and this treatment has the effect of driving any sulphate which has penetrated beyond the surface layers towards the outer pores of the carrier in the manner described in Specification No. 498,828.

The invention further includes a modification of the method of preparing the sub-sulphide catalyst which comprises the step of adding the carrier, consisting—*e.g.*, of china clay pellets and containing a surface layer of a nickel or cobalt salt containing sulphur and oxygen—*e.g.*, nickel or cobalt sulphate—to the top of a catalyst bed which is already at work, decomposing organic sulphur compounds, at the appropriate temperature in coal gas, substantially free from hydrogen sulphide. Catalyst is removed at intervals from the bottom of the catalyst bed. Reduction of the sulphate to sub-sulphide takes place rapidly under these conditions and the withdrawn catalyst may be employed without further treatment.

Following is a description by way of example of one method of carrying the invention into effect in preparing a nickel sub-sulphide catalyst for use in the purification of coal gas from organic sulphur compounds. China clay pellets having a porosity of 25% (*i.e.*, taking

up 25% of their own weight of water) are heated in a boiling aqueous solution made up from 10 parts of nickel sulphate ($6\frac{1}{2}$ H_2O) and 15 parts water. Excess liquid is drained away and the pellets dried rapidly at about 100°C. for one hour. The deposit of nickel sulphate is reduced in a stream of coal gas at a temperature of 350°C. for two hours. The resulting nickel sub-sulphide catalyst (Ni_3S_2) was found to be extremely active for the catalytic decomposition of organic sulphur compounds at temperatures, *e.g.*, of 200° to 225°C. from coal gas which has previously been freed from hydrogen sulphide. This catalyst is more active than the catalyst produced by direct reduction of nickel chloride and subsequent conversion of the reduced nickel to nickel sub-sulphide, and fewer precautions are needed in its preparation. The catalyst thus prepared may replace the catalyst employed in Specification No. 489,398.

Wartime Aspects of Benzole Recovery

Discussion on Paper by K. Sheard to the Scottish Junior Gas Association (Western District)—see "JOURNAL" of Jan. 22, p. 152

Mr. GRAHAM (Glasgow, Vice-President of the Association), opening the discussion, complimented Mr. Sheard on his very practical Paper. He appreciated the standardized design and simplicity of the plant under present conditions, as the time for manufacture would be greatly reduced.

Mr. SMITH (Dumbarton) said he had hoped that the speaker would mention the financial side of benzole production, and regarding calorific value he thought the question did not enter, as the calorific value had to be raised at all costs before benzole was extracted, if the undertaking produced a gas of low calorific value, say, below 440 B.Th.U. per cu.ft.

Mr. STURROCK (Greenock), speaking of reduced calorific value, was of the opinion that should some undertakings lower their calorific value by 25 to 30 B.Th.U. per cu.ft. many of the water heating appliances would be badly affected. He expressed the view that benzole production had not been up to standard from Scottish coals, and the quality of coke produced depended entirely on the coal used.

Mr. MCGOWAN (Glasgow), having had experience of benzole production, spoke of the difficulty he had experienced with the water supply. Originally the circulated water had returned along with oil to a common sump, and later the system was changed to separate the water which then became difficult to cool. Canal water was then substituted for the original mains water, but this led to heavy corrosion in the coolers, making them difficult to clean. He asked Mr. Sheard the best method of cleaning coolers under those conditions. Regarding the economic question Mr. McGowan thought this should not enter at present, and that all gas-works should be forced to extract benzole during wartime. In closing he asked Mr. Sheard the best method of obtaining the toluene content of the crude product.

Mr. GREGG (Glasgow) said he had no modern experience of benzole extraction, but as a citizen he thought benzole should be removed from coal, although as a gas engineer he was not so enthusiastic. He said that when a plant was working at capacity the necessary increased throughput was impossible, and preferred reduction in calorific value to larger throughput in works of calorific value with over 450 B.Th.U. per cu.ft.

Mr. FULTON (Paisley) asked Mr. Sheard what effect carburetted water gas and fluctuating water supply on relays would have on benzole production.

Mr. KIRK (Motherwell, President of the Association), concluding the discussion, said that benzole production in wartime was of paramount importance. Regarding the coke market he was of the opinion that it was a growing factor, and if a new market had to be found, then the success of benzole production was doubtful. He thought that coke sales in Scotland suffered by the difficulty of co-operation, owing to the geographic situation of the works compared with areas in England. He was annoyed that a sufficient increase in the price of coke had not been allowed to overcome the raised price of coal. He agreed that benzole plants must be standardized to give competitive prices to buyers. He asked Mr. Sheard if the use of town water in a closed circuit was advisable. Concluding, Mr. Kirk said he was of the opinion that standardization of coke quality was impracticable, because the coals used were supplied from various pits.

The Author's Reply

Mr. SHEARD, replying, said that the standardized design for the smaller plants had been of considerable assistance in dealing with the large number of enquiries received during the early stages of the war. The time required for construction and putting into operation was a matter of primary importance, and the standardization had been particularly useful in this respect. It should be appreciated, however, that these units were intended primarily for works of under one and a half million cu.ft. of gas per day capacity.

The financial side of benzole recovery had been avoided because so much had been said on this aspect in the past, and it was felt that little that was new could be added. Each undertaking seemed to have its own ideas on just how the balance-sheet should be presented, and what should be included, and there was much to be said for the various methods put forward. Additional costs in coal, steam, cooling water and gas oil were certainly involved, but in the majority of cases these were more than counterbalanced by the revenue obtained from benzole, naphtha, and the increased coke and tar produced.

Where the gas-making plant was of sufficient capacity to handle the increased coal to be carbonized, the attitude of regarding the benzole plant as a bulk consumer seemed fully justified, and no gas undertaking would refuse to accept such business, particularly as it could be stopped at will when excessive peak loads for gas had to be met.

Where the declared C.V. of the gas was below 440 B.Th.U. per cu.ft., it was probably not practicable to reduce the C.V. still further by benzole extraction, and in such cases an increase at inlet benzole plant was necessary. At works with vertical retorts and a high declared C.V. it might be difficult to obtain the required increase in C.V. in the retort house, especially where certain types of coal were being carbonized, and in such cases a statutory change in declared C.V. was well worthy of consideration. At some works a combination of the two methods might be best from a practical point of view, so as to reduce the effect of the altered C.V. on the appliances on the district.

The quantity of benzole available in gas produced from Scottish coals was generally slightly lower than from other coals, such as S. Yorks, &c., but the main items which influenced the quantity and the composition of the benzole produced were the type of carbonizing system employed and its method of operation. Regarding the cleaning of coolers, where the trouble was due to formation of scale on the cooler tubes, there were several preparations on the market which could be effectively used. These were in liquid form and contained an inhibitor to prevent any attack on the metal itself.

The toluene content of crude benzoles could be determined by the use of the Coleman method, but this was not very rapid, and where a quicker method was required a laboratory fractionation of the crude using a column of the Dufton type gave very good results. The Dufton apparatus was obtainable from laboratory suppliers, but a home made column could be devised on the lines suggested in a Paper given to the Northern Coke Oven Managers' Association by H. M. Lowe and published in the *Gas World* of Aug. 6, 1938. Very good results could be obtained with such an arrangement.

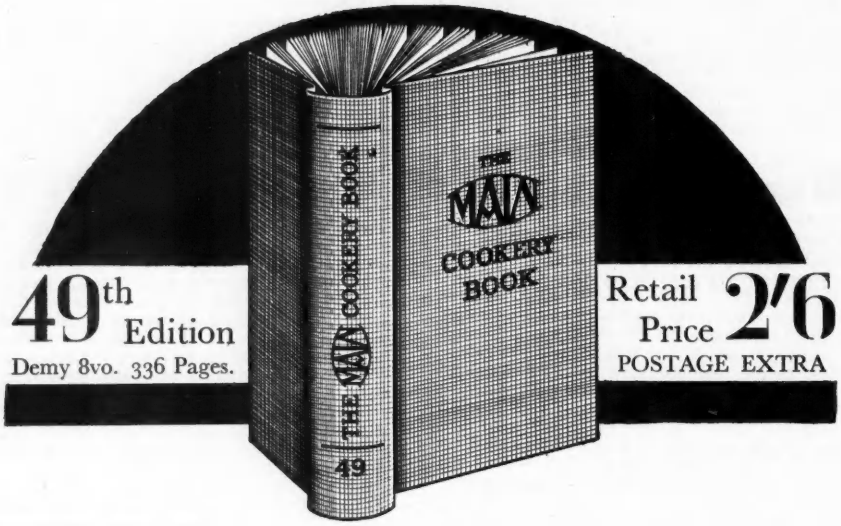
The effect on benzole production of washing a mixed gas stream containing carburetted water gas was to produce a benzole with a slightly higher content of unsaturated hydrocarbons and a lower paraffin content. The specific gravity of the benzole would be slightly raised. The extent of these factors, of course, depended on the percentage of water gas and on the amount of oil used in carburetting. Where fluctuating water supply was experienced in connexion with relays of the "Arca" type, the best solution was to instal a small overhead water feed tank at such a height so as to give the necessary 10–15 lb. sq. in. pressure at the relay.

Replying to Mr. Kirk, there was one item in favour of benzole recovery which had perhaps not been emphasized in the Paper—namely, the reduction of the organic sulphur content of the gas by some 30% as a result of normal benzole extraction. The actual financial value of this reduction was difficult to assess, but some allowance should be made for it on the credit side of the balance-sheet. When considering the economics of the question, providing all the costs involved relating to the benzole plant were included in the balance-sheet, then the profit or loss shown was a clear net value.

The use of town water in a closed circuit was well worth while where surface water for cooling was not available, and the use of town water without recirculation was prohibitive on account of cost. It must be agreed that the question of standardization of coke quality was rather in the nature of an ideal at the present time, and it was fully appreciated that there were many difficulties to be overcome before it could be considered a practical possibility.

The Offices and Laboratories of the Gas Testing Section, Board of Trade, will be returning from Blackpool to London on Feb. 21, from which date all letters and apparatus for the attention of that Section should be directed to Chapter Street House, 26, Chapter Street, London, S.W. 1.

Approval Was Given by the Lincoln City Council recently to a scheme for joint readings of the gas and electricity meters and for the rendering of joint accounts to consumers for all supplies of gas and electricity. The scheme, drawn up by the City Treasurer, provided that instead of all meters being read at the end of a quarter, a continuous meter reading procedure should be adopted, the city being divided into three districts for this purpose. Instead of five or six meter readings going out from the Gas and Electricity departments, all meters will be read by a small staff of two or three men attached to the City Treasurer's Dept., who will read both gas and electricity meters and will be constantly employed on the work. It will be necessary to transfer to the City Treasurer's Dept. suitable men at present employed on meter reading in the Gas and Electricity depts. The issuing of a joint form of account instead of separate statements will affect a considerable saving in paper. Subject to the necessary details being worked out in consultation with the Gas and Electricity Engineers, the scheme will commence on April 1.



The Subject of Nutrition

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The London Market

Feb. 17.

Prices of Tar Products in the London market remain unchanged at the following levels: Pitch nominal; creosote 4¾d. to 5d. per gallon; refined tar 3¾d. to 4d.; pure toluene under the Ministry of Supply Toluene No. 2 Order is 2s. 5d.; pure benzole is 1s. 10d.; 95/160 solvent naphtha 2s. 3d.; and 90/160 pyridine about 15s. 0d.; all per gallon naked; refined crystal naphthalene £23 per ton in bags; all *ex* Makers' Works.

The Provinces

Feb. 17.

The average prices of gas-works products during the week were : Pitch and Crude Tar,* Toluole, naked, North, 1s. 10d. (controlled by the Control of Toluene No. 2 Order, July 5, which fixes the maximum price at which this material may be sold). Coal tar, crude naphtha, in bulk, North 9½d. to 10d. Solvent naphtha, naked, North, 1s. 9d. to 1s. 10d. Heavy naphtha, North, 1s. 5d. to 1s. 6d. Creosote, *ex* works, in bulk, North liquid and salty, 4¼d. to 4¾d. ; Scotland, 4¼d. to 4¾d.; low gravity, 4¼d. to 4¾d. Fuel Grade 4d. to 4¼d. Carbolic acid, 60's, 3s. 9d. to 3s. 10½d. Naphthalene, £15 to £20. Salts, 75s. to 85s., bags included. Anthracene, "A" quality, 4¼d. to 4¾d. per minimum 40% purely nominal. Heavy oil: Unfiltered anthracene oil (min. gr. 1,080), 5¼d. to 5¼d.; filtered heavy oil (min. gr. 1,080), 5¾d. to 6d.; heavy anthracene oil gr. less than 1,080, 6d. to 6¼d.

* In regard to pitch and crude tar prices we would ask readers to refer to the editorial note in our issue of Sept. 4, 1940, p. 404.

Tar Products in Scotland

GLASGOW, Feb. 15.

Production of most products is well looked after and prices generally are firm.

Refined tar is in small but steady call at 4½d. to 4¾d. per gallon in the home market and 3¼d. to 3½d. per gallon for export, both f.o.r. naked.

Creosote oil is well looked after locally at the following prices: Specification oil, 5d. to 5¼d. per gallon; low gravity, 6d. to 6½d. per gallon; neutral oil, 5¾d. to 6d. per gallon; all *ex* Works in bulk.

Cresylic acid is quietly steady with supplies available as under: Pale, 99/100%, 2s. to 2s. 2d. per gallon; Pale, 97/99%, 1s. 9d. to 1s. 10d. per gallon; Dark, 97/99%, 1s. 6d. to 1s. 7d. per gallon; all *ex* Works in buyers' packages.

Crude naphtha continues to be valued at round 6½d. to 7½d. per gallon *ex* Works in bulk, according to quality.

Solvent naphtha is commanding 1s. 8½d. to 1s. 9d. per gallon for 90/160 grade and 1s. 4½d. to 1s. 5½d. per gallon for 90/190 heavy naphtha.

Pyridines show no activity with values nominal at about 17s. to 18s. per gallon for 90/160 grade and 19s. to 20s. per gallon for 90/140 grade.

Diaries, Calendars, &c., Received.

Seasonable gifts in the form of Calendars, Diaries, &c., have been received from the undermentioned friends, whose good wishes are cordially reciprocated:

Fleetway Press, 11–21, Emerald Street, W.C. 1.

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GAS STOCKS AND SHARES

Investors will have seen by now the announcements by the Directors of the three Metropolitan Gas Companies stating with regret that they are unable to recommend the payment of dividends on their preference stocks for the past half-year. Those with a knowledge of the districts served by these undertakings will probably not be surprised at the news. A very large proportion of consumers have evacuated and many of those deciding to remain have suffered through enemy action. With rising costs, especially of coal and other materials, it has doubtless been impossible to cut expenditure to meet the changed conditions, a state of affairs which may well persist if adequate supplies are to be maintained. The South Suburban Gas Company, on the other hand, is meeting its preference dividends and distributing 1% on the ordinary stock, making 3% for the full year as compared with 4½% in 1939.

At the time of writing the effect on the prices of the various stocks is unknown, but obviously some adjustment will be necessary, and before the notice appeared South Metropolitan 6% preference declined 9½ points to 95. Other changes of note in the Official List were those of Bournemouth 4% debenture which rose 8 points to 89½ and Imperial Continental 3½% debenture with a gain of 13 to 77½. No movements of importance took place in the other lists.

Among the undertakings in the Provinces it is gratifying to note that Sheffield and Liverpool are maintaining the 1939 rates of dividend at 6½% and 6% respectively for the past year.

Quotations on the London and Provincial Stock Exchanges

OFFICIAL LIST

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Feb. 13.	Rise or Fall on week.
1,767,439	Sept. 16	7	7	Alliance & Dublin Ord. ...	103—108	...
374,000	Dec. 30	4	4	Do. 4 p.c. Deb. ...	90—95	...
957,608	Nov. 4	5	5	Asscd. Gas & Water U'd'ts Ord.	11/6—13/6	...
500,000	,,	4½	4½	Do. 4½ p.c. Red. Cum. Pref.	14/6—16/6	...
335,545	,,	4	4	Do. 4 p.c. Red. Cum. Pref.	14/6—16/6	...
336,646	,,	4	4	Do. 4 p.c. Irred. Cum. Pref.	12/—14/-	...
561,370	Aug. 12	7	7	Barnet Ord. 7 p.c.	97—102	...
300,000	Oct. 14	1/9⅜	1/4⅛	Bombay, Ltd.	19/6—21/6	...
690,407	Aug. 19	7	7	Bournemouth 7 p.c. max. ...	105—115	...
362,025	Dec. 16	4	4	Do. 4 p.c. Deb. ...	87—92	+8
659,955	Aug. 19	6⅜	4⅜	Brighton, &c., 5 p.c. Con. ...	65—75	...
855,000	Sept 30	8	6	Brit. Gas Light Ord.	75—85	...
545,000	Dec. 16	5½	5½	Do. 5½ p.c. 'B' Cum. Pref	105—115	...
120,000	,,	4	4	Do. 4 p.c. Red. Deb.	73—78	...
10,000	Nov. 6 '33	6	4	Cape Town, Ltd., 4½ p.c. Cu. Pf.	¼—½	...
626,860	Feb. 3	6	6	Cardiff Con. Ord.	87—92	...
24,500	Sept. 23	7	7	Colombo 7 p.c. Pref.	19/—21/-	...
764,169	Oct. 7	-/11.48	-/11.48	Colonial Gas Assn. Ltd. Ord. ...	14/—16/-	...
400,000	,,	1/3.30	1/3.30	Do. 8 p.c. Pref. ...	19/—21/-	...
1,748,935	July 22	2	3	Commercial Ord.	30—40	...
620,000	Dec. 9	3	3	Do. 3 p.c. Deb.	57—62	...
286,344	Aug. 19	5	5	Do. 5 p.c. Deb.	87—92	...
807,560	Aug. 12	7	6	Croydon sliding scale	80—85	−3
644,590	,,	5	5	Do. max. div.	75—80	...
620,385	Dec. 30	5	5	Do. 5 p.c. Perp. Deb. ...	90—95	...
179,500	Feb. 10	5	5	East Surrey 'B,' 5 p.c. ...	60—70*	...
176,461	Dec. 16	5	5	Do. 5 p.c. Deb. (Irred.)...	87—92	...
250,000	Nov. 11	4	6	Gas Consolidation Ord. 'B' ...	13/6—14/6	...
250,000	Nov. 11	4	4	Do. 4 p.c. Red. Cum. Pref.	15/—17/-	...
19,123,018	July 29	3⅜	4½	Gas Light & Coke Ord. ...	12/—14/-a	...
2,600,000	,,	3½	3½	Do. 3½ p.c. max.	45—50	...
4,477,106	,,	4	4	Do. 4 p.c. Con. Pref. ...	68—73	...
2,993,000	July 8	3¾	3¾	Do. 3¾ p.c. Red. Pref.	78—83	...
8,602,497	Dec. 2	3	3	Do. 3 p.c. Con. Deb. ...	70—75	+1
3,642,770	,,	5	5	Do. 5 p.c. Red. Deb. ...	100—105	...
3,500,000	,,	4½	4½	Do. 4½ p.c. Red. Deb. ...	99—104	...
700,000	Sept. 9	3½	3½	Do. 3½ Red. Deb. ...	80—85	...
8,600,000	May 13	4	8	Imperial Continental Cap. ...	43—48	−1
43,820	Jan. 27	3½	3½	Do. 3½ p.c. Red. Deb. ...	75—80	+13
231,978	Aug. 19	5	5	M.S. Utility 'C' Cons.	68—73	...
918,657	,,	4	4	4 p.c. Cons. Pref.	72—77	...
675,000	Nov. 11	†4	†4	Montevideo, Ltd.	52—57	...
300,000	Nov. 18	7	9	Oriental, Ltd.	105—115	...
368,537	Dec. 9	8	6½	Plymouth & Stonehouse 5 p.c.	88—98	...
621,667	Feb. 3	7½	7½	Portsmouth & Gosport Cons.	90—93	...
648,999	Sept. 16	1/1	1/1½	Severn Val. Gas Cor. Ld. Ord.	13/—15/-	...
597,972	,,	-/10⅝	-/10⅝	Do. 4½ p.c. Cum. Pref. ...	15/6—17/6	...
2,528,714	Sept. 2	1/-	-/7⅛	South East'n Gas Cn. Ld. Ord.	8/—10/-	...
1,000,000	,,	-/10⅛	-/10⅛	Do. 4½ p.c. Red. Cum. Pref.	14/—16/	...
1,068,869	,,	4	4	Do. 4 p.c. Irred. Cum. Pref.	11/6—13/6	...
4,709,895	Aug. 5	4	4	South Met. Ord.	43—48	...
1,135,812	,,	6	6	Do. 6 p.c. Irred. Pref. ...	90—100	−9½
850,000	,,	4	4	Do. 4 p.c. Irred. Pref. ...	69—74	...
1,895,445	Dec. 30	3	3	Do. 3 p.c. Perp. Deb. ...	58—63	...
1,000,000	Jan. 15	5	5	Do. 5 p.c. Red. Deb. ...	97—102	...
1,543,795	July 22	3	4	South Suburban Ord. 5 p.c. ...	62—67	...
512,825	July 8	5	5	Do. 5 p.c. Perp. Pref. ...	80—85	...
500,000	,,	4	4	Do. 4 p.c. Perp. Pref. ...	63—68	...
250,000	,,	3⅜	3⅜	Do. 3⅜ p.c. Red. Pref. ...	80—85	...
888,587	Dec. 16	5	5	Do. 5 p.c. Perp. Deb. ...	93—98	...
750,541	Feb. 10	5	2	Southampton Ord.	57—62*	...
350,000	Feb. 10	5½	5½	Swansea 5½ p.c. Red. Pref. ...	91—96*	...
1,076,495	Aug. 5	5	5	Tottenham & District Ord. ...	62—67	...
338,555	,,	5	5	Do. 5 p.c. Pref.	80—85	...
453,380	Dec. 9	4	4	Do. 4 p.c. Perp. Deb. ...	76—81	...
1,247,505	May 20	4	6	U. Kingdom Gas Cor. Ord. ...	13/—15/-	...
1,085,952	Nov. 25	4½	4½	Do. 4½ p.c. 1st Cum. Pref. ...	13/6—15/6	...
772,709	,,	4	4	Do. 4 p.c. 1st Red. Cum.Pref.	13/—15/-	...
745,263	Dec. 16	4½	4½	Do. 4½ p.c. 2nd Non.Cum. Pf.	12/—14/-	...
1,200,000	Sept. 9	3½	3½	Do. 3½ p.c. Red. Deb. ...	84—89	...
380,608	Aug. 5	7	6⅜	Uxbridge, &c., 5 p.c.	80—90	...
1,371,138	July 8	3½	4	Wandsworth Consolidated ...	66—71	...
2,525,768	,,	4	4	Do. 4 p.c. Pref.	60—65	...
1,343,964	Dec. 16	5	5	Do. 5 p.c. Deb.	92—97	+2
383,745	,,	4	4	Do. 4 p.c. Deb.	75—80	...
558,342	July 15	6	5	Watford & St. Albans Ord. ...	85—90	...
300,000	Dec. 9	3½	3½	Do. 3½ p.c. Red. Deb. ...	84—89	...

SUPPLEMENTARY LIST

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Feb. 13.	Rise or Fall on week
351,685	Dec. 16	5	5	Brighton, &c., 5 p.c. Perp. Deb.	88—93	...
28,700	,, 17	5½	5½	Do. 5½ p.c. Red. Deb. 1942 ...	95—100	...
415,250	,, 23	4	4	Bristol Gas Co., 4 p.c. New Deb.	83—88	...
140,205	Feb. 3	7	7	Cambridge, &c., 7 p.c. Cons. 'B'	100—110*	...
295,932	Aug. 19	5	5	Cheltenham, 5 p.c. Cons. Ord....	88—93	...
42,500	Dec. 16	4	4	Do. 4 p.c. Perp. Deb....	75—80	...
150,000	Aug. 12	4	4	Croydon Gas, 4 p.c. Pref. (Irr.)	65—75	...
130,000	Dec. 30	4	4	Do. 4 p.c. Deb. ...	75—80	...
146,700	Feb. 10	5½	5½	East Surrey, 5½ p.c. Pref. 'A' ...	80—90*	...
53,220	,, 10	6	6	Do. 6 p.c. Cum. Pref. ...	90—100*	...
117,425	Feb. 5	8	8	East Wight, 5 p.c. Cons. Ord. ...	100—110	...
...	Aug. 19	6	4	Eastbourne, 'B' 3½ p.c.... ...	65—75	...
239,135	Nov. 11	5	5	Gas Consolidation 'A' Ord. (£1)	13/—15/-	..
156,600	Aug. 19	5	5	Hampton C't, 5 p.c. Cons. Ord.	68—73	...
18,000	Dec. 2	7	7	Malta & Med'n., 7 p.c. 1st Pref.	50—60	−5
10,845	,, 2	7½	7½	Do. 7½ p.c. 2nd Pref.	50—60	−5
50,000	Aug. 19	£5 19 6	£5 4 6	Mid. South. Util., 'A' Cons. 5 p.c.	60—70	...
65,000	Aug. 12	5	5	North Middlesex, 5 p.c. Pref. ...	87—92	...
70,000	Sept. 9	5	5	Plymouth & Stone., 5 p.c. Deb.	87—92	...
76,501	Dec. 30	4	4	Reading, 4 p.c. Perp. Deb. ...	70—75	...
74,777	Sept. 30	4	4	Romford, 4 p.c. Debs. (Reg.) ...	77—82	...
21,000	Dec. 16	5	5	Slough, 5 p.c. Perp. Deb. ...	87—92	...
211,740	,, 30	5	5	Southampton, 5 p.c. Red. Deb.	90—95	...
363,575	Dec. 30	5	5	Tottenham, 5 p.c. Reg. Red. Mt.	94—99	...
202,019	Oct. 14	6⅜	6⅜	Tunbridge Wells, 4 p.c. Scale ...	67—72	...
135,257	June 10	5	5	Uxbridge &c., 5 p.c. Perp. Deb.	88—93	...

PROVINCIAL EXCHANGES

					Quotations Feb. 7.	
47,756	July 26	6	5	Bath Cons.	94—98	...
122,577	July 22	7	6	Blyth 5 p.c. Ord.	100—105	...
1,667,250	July 15	5	5	Bristol, 5 p.c. max.	87—89	−2
120,420	Dec. 16	4	4	Do. 1st 4 p.c. Deb.	92½—94½	...
415,250	,,	4	4	Do. 2nd 4 p.c. Deb.	91—94	...
328,790	,,	5	5	Do. 5 p.c. Deb.	107—110	...
157,150	Feb. 3	5	6½	Chester 5 p.c. Ord.	98—101*	...
92,500	Dec. 16	4	4	Do. 4 p.c. Pref.	79—84	...
36,430	,,	3½	3½	Do. 3½ p.c. Deb.	79—84	...
41,890	,,	4	4	Do. 4 p.c. Red. Deb. ...	93—97	...
542,270	Aug. 12	9	6	Derby Cons.	100—105	...
55,000	Dec. 16	4	4	Do. 4 p.c. Deb.	75—80	...
10,000	Aug. 19	10	10	Great Grimsby 'A' Ord. ...	165—175	...
6,500	,,	10	10	Do. 'B' Ord. ...	165—175	...
79,000	,,	10	10	Do. 'C' Ord. ...	155—165	...
732,000	Aug. 26	4	4	Hartlepool G. & W. Cn. & New	61—63	...
2,167,410	Aug. 19	6	6	Liverpool 5 p.c. Ord.	90—94	...
245,500	Dec. 16	5	5	Do. 5 p.c. Red. Pref. ...	97½—100½	...
306,083	July 15	4	4	Do. 4 p.c. Deb.	88—100	...
20,000	Dec. 23	5	5	Long Eaton 5 p.c. Pref.	9—11	...
80,000	,,	5	5	Do. 5 p.c. Deb.	87—92	...
2,430,267	July 29	5 7/10	5	Newcastle and Gateshead Con.	16/6—17/6a	...
682,856	,,	4	4	Do. 4 p.c. Pref.	75—77	...
776,706	Dec. 23	3½	3½	Do. 3½ p.c. Deb.	80—85	...
277,285	Oct. 21	5	5	Do. 5 p.c. Deb. '43 ...	97—102	...
274,000	July 26	5	5	Newport (Mon.) Ord.	89—93	...
13,200	Sept. 16	8⅝	7	Pontyp'l Gas & W. 10 p.c. 'A'	11½—12½	...
13,600	,,	6	5	Do. 7 p.c. 'B'	9½—10½	...
40,000	,,	5	6	Do. 7 p.c. 'C'	9½—10½	...
106,280	Aug. 5	8	10	Preston 'A' 10 p.c.	157—167	...
188,219	,,	7	7	Do. 'B' 7 p.c.	113—123	...
1,806,339	Aug. 26	6½	6½	Sheffield Cons.	114—116	...
95,000	Jan. 6	4	4	Do. 4 p.c. Deb.	96—98	...
332,351	Feb. 3	6	6	Sunderland 6 p.c. max. ...	107—112*	...
140,778	Aug. 12	5	5	Weston-super-Mare Cons. ...	80—85	...
64,338	Dec. 30	4	4	Do. 4 p.c. Deb.	80—85	...
33,340	,,	7½	7½	Do. 7½ p.c. Deb.	135—140	...

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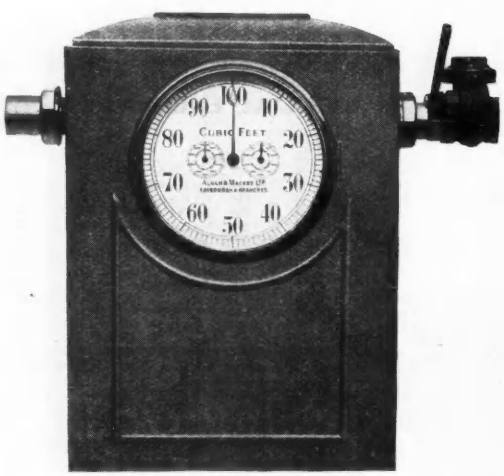

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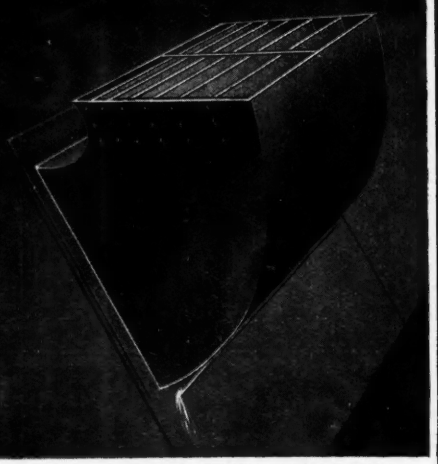

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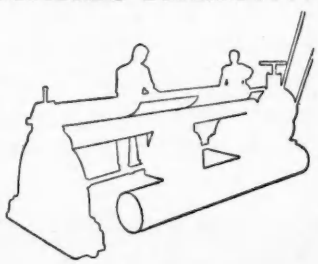

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